A Mouse's Tale

. . . a practical explanation and handbook of motivation from the perspective of a humble creature

A. J. Marr

"Often illuminating and always entertaining! Mouse's Tale gives a scholarly and insightful account of the psychology of motivation, delivered in the engaging style of AJ Marr's alias as 'Dr. Mezmer'"

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links to all of the thirteen open-source books by this author from psychology to satire are on pp.236-239

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Prologue

Any explanation of the world requires a foundation on a reliable and precise observation *of* the world. Without this, the cathedrals of logic we build are set upon a foundation of shifting sands and can collapse upon the slightest gust of one contrary fact. For philosophy and its splintering offshoots in the social sciences from psychology to economics to literature, human behavior is perennially rooted in metaphor, or images of how the mind works that are not grounded to how the mind actually works. This is quite understandable, because until recently no one frankly knew. While the physical sciences progressed in tandem with the ever-increasing resolving power and precision of their instrumentalities, understanding human behavior and how it is instantiated by the human brain has had to bide its time, until now.

How we think is dependent on how we observe, and the tools we use to sharpen the precision and clarity of what we see. In physics, these tools rapidly advanced from the ancient astrolabe to Galileo's crude telescope to the massive observatories and atom smashers of the present day. Now we can observe the entire universe and its scale from the galactically large to the infinitesimally small, and to a degree, explain it.

Despite the precision of modern-day instrumentalities of observation, from brain scans to the direct observation and activation of brain cells, the human mind continues to be viewed as just as intractable and resistant to easy categorization and explanation. To a degree, this is true, as the processes that underlie thinking, perception, emotion, and even consciousness itself remain uncertain in observation and contentious in debate.

However, just as in physics certain subject matters and their embodied rules from the laws of motion to quantum mechanics are explainable and fruitful in terms of the procedures they suggest and the mechanisms from computers to rockets that they instantiate, so too in psychology are many foundational problems resolvable, and with procedures unexpected and profound. In this book, we will argue that one of these subject matters is the concept of motivation, or learning. Like the corollary concept of the atom, motivation hinges on the concept of reinforcement, reward, or as more to the point, incentive. This near irreducible concept has been the subject of decades of research, speculation, and argument, and ironically in a philosophical world as inchoate as ever, has come to a resolution, borne by observation of the actual neural processes that instantiate it. It is to address this conceptual resolution that is the subject of that book, and of course, the unsung hero of our piece, the laboratory mouse. It is from a mouse's point of view that we will demonstrate how learning, motivation, affect, and emotion are derivable from simple neural processes and structures of ancient origin, and how our hopes and desires are woven from the most rudimentary impulses that all mammals share. A humbling perspective, but a liberating one too, as we will demonstrate that happiness is found in the ability to observe new fields of vision, with objects novel and profound forever in transition. We only need to know how to arrange them, with a knowledge that we will demonstrate can be in the possession of anyone.

The ability to understand and remedy the seemingly intractable social problems of our time ultimately depends upon a true understanding of how motivation works, and how the success and happiness of individuals, peoples, and

states depends upon how they arrange incentives and why they succeed, and more often than not, why they fail.

This book will engage the simplicity of explanation and the presumptuousness of procedure to demonstrate that the ultimate solution to our problems is the answer to the question of not how man is like a god, but how he is like a mouse. A modest and humbling perspective to be sure, but conforming to the revolutions in science from Copernicus to Darwin to Einstein, mankind is part of the natural world, not a step above it.

Motivation

"It may be hard for us to accept that human strivings are ultimately driven by the welling up of ancient neurochemicals in primitive parts of the brain. This view does not easily fit into our concept of ourselves as moral and spiritual beings. Although the details of human hopes are surely beyond the imagination of other creatures, the evidence now clearly indicates that certain intrinsic aspirations of all mammalian minds, those of mice as well as men, are driven by the same ancient neuro-chemistries. These chemistries lead our companion creatures to set out energetically to investigate and explore their worlds, to seek available resources and make sense of the contingencies of their environments. These same systems give us the impulse to become actively engaged with the world and to extract meaning from our various circumstances." Jaak Panksepp

Motivation is everywhere, and we are never without it, nor cease obsessing about it. We are always motivated to go somewhere, to do something, it is but the direction we move that satisfies, baffles, and at times, appalls. Such is the nature of the human condition. Motivation, like the wind, is a constant, yet it is the tilt of the wind vane to the gusts of affect that gives us pause, when by all reason it should always point north. On the way we are aroused, and depressed, have pleasure and are in pain, with incentives and guideposts from real to obscure to where we are and where we should be going.

Motivation is hard, and the entire human compass of philosophy, psychology, literature, and art endlessly spins around in an effort to understand and manipulate it for our edification and pleasure. It didn't help much that humans are a world apart from their mammalian cousins, whose

behavior did not share in the divinity. So, they are ignored, or have been until now, in favor of a humanity inexplicable, unexplainable, and just plain ornery.

We can't be faulted for giving a go at this Damoclean knot of behavior, puzzle solving is in our nature. But where to start? Underscoring all moral, religious, political, and individual philosophy are first principles. At least that is a rationalist's aim. From the fall of an apple to the evolving beak of a finch to the mind experiment of a train racing against a beam of light, revolutions from Newton to Darwin to Einstein travel first on the wings of simple metaphors from the mathematic to poetic. Simple observations are used to weave new perspectives of the world that predict events mundane and unexpected, and do so because they are testable, and they are testable because they *explain*. Explanations provide the seed for their evolution, validation, or destruction. They are mutable conceptual objects that must be subject to criticism. They are the essence of the scientific enterprise.[1]

In philosophy and psychology, motivation is divergent from the rude and simple impulses of animals. Our minds are made and made up by profounder stuff that uniquely separates us from our mammalian relatives. In this book I will argue differently that motivation is *emergent* from elementary and foundational principles that we share in common with our mammalian cousins and is not detached from them. In other words, the conscious and non-conscious cognitions that drive behavior occur because they are embodied by primary instincts that gives them direction and indeed, a reason to be.

Motivational theories are essentially *learning* theories, which describe how information or experience influences behavior, and at its core changes the neuronal fabric of the

mind. The basic processes of how we learn require a reason why we select the information we process, retain, and forget, and this is embodied in ancient structures in the brain that govern affect, or core feelings of pleasure, pain, and arousal.

These structures are the same in all mammals, and it follows that core motivational principles may be revealed by studying the humblest of creature, such as cats, dogs, birds, and of course, the mouse. And so has the entire psychology of motivation or learning been marked and developed from the turn of the 19th century to the present day.

Ironically, the history and development of learning theories owe nothing to philosophy and its cultural manifestation in media and the arts. Indeed, they could not, since they are derived from the natural science of the humblest of creatures. There is an advantage in this, as theories of learning did not have to be encumbered by the profligate metaphors of motivation that have so inspired the literary imagination, or account for every fact about behavior, no matter how obscure.

When considered as a practical discipline, or how it is used in everyday life, science does not aim for *observational adequacy*, or accounting for everything that is there, with an exhaustive and discrete enumeration of every data point, and a pigeonhole for every observation.[2] Rather, it aims for *explanatory adequacy,* and to provide a principled choice between competing descriptions, a precise mapping of its terms (syntax) to underlying observable structure (semantics), and a broad predictive power. It is also usable, and can scale its metaphorical structures to fit the nature of every problem and the level of any individual's understanding. The language of science as an explanatory discipline is spare in its lexicon and precise in its

descriptions, and although it may not capture all of reality, nonetheless allows for theories of great simplicity and scope, with a predictive power that renders them testable and subject to easy correction.

Like its counterparts of mass and force in the physical sciences, incentive as defined through a neurologically grounded theory of learning is also simple and elegant.[3] But elegance and simplicity gain our favor because they are easily understood and tested. Indeed, theories of motion are easily refuted if the machines we design using their mechanics never get off the ground or crash into it. Likewise, learning theories that postulate how incentives put human beings in motion are continually subject to criticism and refutation, if only because we too with bad advice can proverbially crash and burn.

To understand the rudiments of learning, rudimentary organisms have provided learning theorists with the elementary perspective to understand how the environment selected not only the physical attributes of a species, but its mental attributes as well. The overarching certainty that all life must confront is that their world is at root, uncertain. How to process uncertainty, and to a degree anticipate and seek it out, is key to survival, and in the moment, the motivations that drive our ancestors, and us as well. The thread of our core argument in this book stems from this root concept of uncertainty or discrepancy that has been revealed by cognitive and affective neuroscience as the essence of incentive, reinforcement, or reward, and from such a thread a new conceptualization of incentive motivation and its implications and confirming procedures will be woven.

And to start our journey, we will begin with a little doe.

Basic Instincts

A doe's life.

How to think when one does not have a brain is a scarecrow's lament, and is an uncharitable perspective we give to our mammalian cousins, whose motivations are impoverished facsimiles of the fecund intellectual and emotional lives of humans. Yet in spite of this, an animal's needs are as pressing as ours, and even more immediate. Food, shelter, a reliable mate, and an awareness of predators all are daily uncertainties, and the most important and indeed continuous instinct is to render comforting certainties from an uncertain world. To effect this an unthinking animal must be *affective*, and be attentively aroused by the prospect of novel and useful information. This is the basis of the foraging or 'seeking' instinct, which is the driving impulse for all mammals, and in service of their other needs consumes nearly all their waking lives.[4] It also, as I will demonstrate, consumes our lives as well.

All living things exist in unpredictable, uncertain environments. Our invertebrate ancestors could only react to the stimuli they bumped into, or which bumped into them, which in best cases they devoured, or at worst, devoured them. For our ancestors, as it is for us, uncertainty is a continual aspect of the world, and rendering the world safe and certain gives but a moments pause, and as the world turns, vigilance must be constant, and must be the default condition for survival. Vigilance, in other words, is the price for survival, and the ultimate good that is found not at the end of the tale, but in its telling.

Consider a typical herbivore in a tropical savannah, past or present. It is born in an uncertain environment where

danger and opportunity lie in every second and with every step. It has the usual assortment of affective impulses from hunger to thirst to fear and sexual attraction that populate its day, but its continuous and overweening impulse is to be wary and aware of new things. Every second, it must convert the uncertainties of its world into comfortable certainties, and ironically it is the uncertainties that must attract. It knows the certainties of its personal space, but it is always seeking to be of aware of new uncertainties to convert to comfortable truths. It seeks the resolution of possibilities, and there in that transition lies its reward.

When possibilities change, new things are perceived, and its experience in a novel environment allow the herbivore, our doe, to survive, and to *learn*. Indeed, the reward for vigilance is felt as positive affect, or arousal that gives temporary value or utility for the decisions that occur in the moment, and is critical to the consolidation of memory, or learning. To survive, animals must always be learning, as the environment is rarely static, and complacency is a call to extinction.

When we take the evolutionary leap to humankind, this is a lesson that is surprisingly ignored. Whether its hubris perhaps, or just neglect, we seem to be a special species, a breed apart. With us, nature has created a new creature, with free will, a large and flexible brain, and a newly bestowed ability by God or nature to rise above or break the slavish dependencies of its cousins.

Nature or God is no slouch of course in designing such a wise man, or homo-sapiens, until you recognize that is what She or He *is*. But an uninspiring nature or divinity is not quite the right word. You see, either has only the time to be economical, not inspiring.

A Topological Constant

"Brains tend to optimize on the basis of what they already have, to add only what is necessary. Over the course of evolution, newer parts of the brain have built on, take input from, and used older parts of the brain. Is it really plausible that the brain would build a whole new system to duplicate what is could use already?...It is only from a conservative philosophical position that one would want to believe in the old faculty psychology—in the idea that the human mind has nothing about it that animals share, that reason has nothing about it that smells of the body." [5] George Lakoff and Mark Johnson

Nature is not a wastrel, and for living organisms it prefers to repurpose parts rather than evolve new ones. For humans, we differ primarily from our mammalian cousins by the much larger size of our neo-cortex, which enables language, thinking, and virtualizing future possibilities. The core neural structures that govern affect have remained for the most part, unchanged. The inference follows that these affective mechanisms govern the same affective impulses. So, just as the affective states of hunger, thirst, anger and lust derive from primitive impulses, so too does the need to explore, and to forever transition to new possibilities from older certainties.

We can visualize, model and copy for posterity the twists and turns of our core motivations as they emerge as patterns of great intricacy, and often, beauty. The products of our thought and the possibilities of creation follow in their inexplicable winding circuit the same paths that our ancestors took, but with a new and complex music that is spun out of the same basic notes. The genius of humanity is not separate from our basic drives, but is emergent from

them, and retains not the form, but the *topology* of the basic yearnings of our ancient ancestors.

In mathematics, topology is concerned with the properties of a geometric object that are preserved under continuous deformations, such as stretching, twisting, crumpling and bending, but not tearing or gluing.[6] Like an oval balloon being contorted and twisted into a bunny or a puppy, the final creation at root still has the topology of a sphere. In its essence, the sphere has not changed. That the physical world is a manifestation of principles that have the same simple topology or form is a simplifying and unifying principle, and allows us to derive from first principles the multi-faceted splendor of the world.

From Balloon to Puppy

The implications of a common topology of motivation is one of simplicity, observability, and practice. In other words, the incentives that motivate animals suggest that human motivation is equally simple to understand, is observable neurologically, and can be predicted and controlled through procedure. Human motivation is eminently explainable, and its embodiment can be understood

through the converging evidence of the multi-metaphorical ways we describe the world. Its principles are simple and easily refutable, and thus open to criticism and correction. In other words, like peer hypotheses in the physical sciences it *solicits* criticism through the ease of testability from a simplicity of terminology that maps rigorously to observable facts, and a generality of predictions that can render it false at every turn.

But before we make this conceptual leap, we must clarify our basic presumptions by grounding them to established fact. To do this we must understand the hundred years or so of research that has revealed, from a mouse's point of view at least, of how motivation works.

Behaviorism gets 'real'

The astute reader will note that this book provides a distinctively *behavioristic* perspective of motivation. The insistence upon observed behavior as the primary datum, and to resist making inferences outside of what the data suggest, represents a behavioristic philosophy. Behaviorism is a thoroughly empiricist approach to understanding behavior, with explanation naturally emerging from the facts as they unfold with observation and experiment. For the theory of motivation, the facts however have been late in coming, as only in the last thirty years have the procedures and tools been developed to truly observe and map the neurophysiological processes that underlie motivation and learning. Nonetheless, 'methodological' behaviorists or 'behavior analysts' ignore the neurologic processes that underscore motivation, using overt and observable behavior as their primary datum. In contrast, a 'radical' behaviorism maps all behavior from the macro

(overt behavior) to the micro (cellular neurological processes) to a uniform data language. A radical behaviorism is the perspective embraced in our arguments and examples to follow, with a radical departure conceptually and procedurally from methodological behaviorism.

If observed behavior maps to molecular or 'granular' aspects of sensori-motor systems (walking, talking, perceiving, thinking), it follows that it must also map to their 'affective' representations as well, or how they correspond to affect or feelings. And it is here that a radical behaviorism reflects the notion of realism. To be realistic is to adequately describe what is 'there' in time and place. Placing a train's arrival in the future when you see it at the gate means that a commuter is not being realistic, or that his observations do not match the perceptual facts. Like the train, affect is important for all the psychological sciences, the issue is where it is to be *placed*. From methodological behaviorism to cognitive science to behavioral economics, feelings are usually posited as the result *of* cognition rather than being intrinsic *to* cognition, and are incidental and not integral to motivation. In other words, feelings are intermittent events that are the consequence of disembodied cognitive or perceptual processes that are responsible for motivation. The problem is that purely cognitive processes have poor predictive power. Like projecting the path of a cannonball without considering the background force of gravity, the predictive capacity of purely cognitive operations always needs to be corrected, which is generally accomplished by the postulation of ad hoc mentalistic processes from intrinsic and extrinsic motivation, 'flow' or meditative states, or the myriad 'biases' which populate behavioral economics. [7]

For the disciplines of cognitive linguistics and affective neuroscience that share the empiric principles of radical behaviorism, affect is a not a *consequence* of cognitive processes or manipulations, but is *intrinsic* to those processes, and to be manipulated these processes must be understood. This concept of 'embodied realism', [8] [9] is that what is real to us from motivation to thought to consciousness emerges from our sensorimotor systems, and that reason and affect conjointly and not independently govern motivation.[10]

How we can proceed to this conclusion represents the rich progress of the history of learning, and its full accounting lies outside the scope of this book, save for the brief overview that we will now present. We will see over the course of a few decades how motivation has become much more than what it at first seems.

Great Expectations

Pushed, Pulled and Glued

Simple and unifying principles are hardly the case with the history of motivation, as handed down in the profound and often confounded history of the social sciences. Motivators are only limited by our ability to compose new metaphors to fit any situation. Thus, the intellectual landscape is populated with need hierarchies, unconscious drives, and other motivating forces from will power to free will that are more rooted in the peculiarities of language than reality. For those experimental psychologists who studied lower animals which did not have the luxury of such a linguistic largesse, these motivating principles were reduced to three. These metaphorical principles were derived from the folkways of physics that we observe that make objects move, separate, and cohere. To this end there are internal and aversive 'drives' that inherently push an organism towards those behaviors that achieve a goal that satiates them, the knee jerk reactions to events that cause attraction or repulsion, and those reinforcing events that metaphorically 'glue' a response to a reward. So we have hunger, thirst, and sex drives, Pavlovian reactions to the slings and arrows, bells and whistles of outrageous fortune, and the Skinnerian metaphor of the reinforcer, an event virtual or real that fixes behavior in its tracks, and increases its likelihood in similar situations.

Pushed

Drives are signaled by the deprivations that populate our life, and through their existence provide a stimulus and guidance for behavior. It is a simple notion and coheres with common sense. After all, the smell of a pie, the shape of a human form, or the approach of a dangerous predator all elicit urges that goad us into action. The prospect of reducing pain and increasing satisfaction 'drives' behavior and is an artifact of the uncomfortable or deprived state in the moment. Drives are the aversive states from hunger to sex to anxiety that instantiate equally unique responses that reduce them.

The drive reduction hypothesis of reward was advanced by the psychologist Clark Hull in the 1940's. The incentive motivation principles advanced by Hull and his students dominated the 1940's and 1950's and were distinguished from the Pavlovian and Skinnerian models of incentive motivation that we will consider next by the complexity of its data language, or syntax. Hull never addressed where 'drive' originated in the brain, nor was that his interest. Rather, Hull developed a complex mathematical model that incorporate drive, habit strength, inhibition, and other inferred modifying variables that could be used to pro-actively predict behavior. His model was designed to encourage refutation and test, and in time it was continually modified but by the end of the century abandoned, as other models of motivation gained ascendancy.

Part of the reason for the complex machinations of drive theory is that whereas reward is about the externalities following performance, drive is about the *internalities* of behavior, the unique deprivations that spark unique behaviors. And because they are internal and were at the time unobservable, it was easier to simply change the

equation to fit the results of experiment, not to match a true observation of the actual neural processes that instantiate them. Although Hullian principles are no longer accepted as explanatory for incentive motivation in animals, that is not the case for humans, where drive theory is alive and well, but in an ad hoc way. Drives restock the cabinet of motivating forces by making motivation an idiosyncratic process that matches idiosyncratic behaviors. For human psychology in particular, 'drives' for achievement, power, security, self-actualization, and more are 'validated' by the inference that they are rooted in unique motivational processes located somewhere in the brain.

Pulled

The simplest behaviors are the most automatic, non-conscious, or 'reflexive'. But that discovery had to wait until the early twentieth century, when in 1900, the physiologist Ivan Pavlov studied the physiology of digestion, and to do this he externalized the organ of digestion, the stomach, but surgically altering his acquiescent subjects, namely dogs, by exposing part of their stomach to physical observation, and noting how gastric secretions correlated with their ingestion of food.[11] He soon discovered that gastric activity occurred not only when the dog was ingesting food, but prior to it, and was signaled by events both unconditioned and 'conditioned'.

Pavlov had discovered, or more to the point, formalized the observation, second nature to us now, that the dog was conditioned to respond not only to the sight of food, but to the precursor stimuli to a feeding, such as time of day, dinner bell, and other extraneous stimuli. Pavlov was soon to recognize that the rudimentary mechanisms of digestion, gastric secretions (salivation) and motility were modifiable

by psychological events mediated through experience, or learning. Responses that were naturally elicited through the ingestion of food were similarly elicited upon the availability of imminent food but also through associated environmental events associated with its delivery. Like a dinner bell eliciting salivation in a hunger dinner patron, the dog similarly responded upon the perception of the stimulus (a bell) that was associated with food. The procedure was simple, and mirrored a learning process as elementary, and through similar procedures Pavlov developed one of the first models of learning, or classical conditioning. In a typical Pavlovian experiment, an unconditioned stimulus or US (food), when paired with a neutral stimulus (a bell) will transfer the same eliciting properties to the new or conditioned stimulus (CS). Through similar procedures, Pavlov's continued to explore the inner world of his subjects and developed the S-R (stimulus-response) motivational concepts that found wide acceptance and applicability in behavior therapies for emotional conditions from phobia to shyness. His exhaustive study of the innumerable permutations of stimuli and response later won him the Nobel prize.

For S-R psychology, unconditioned reflexes are classes of behavior that are uniquely mapped to the language of stimulus and response, like salivation upon hearing a dinner bell, anxiety before a test, or aroused attention upon hearing a loud noise. Indeed, this observation provided a neat dichotomy for the classes of involuntary responses (muscular tension, salivation, arousal) that were *elicited* by stimuli, and those voluntary responses (walking, talking, thinking) that were *emitted* to achieve discrete future results, a notion that in the present day has been proven wrong,

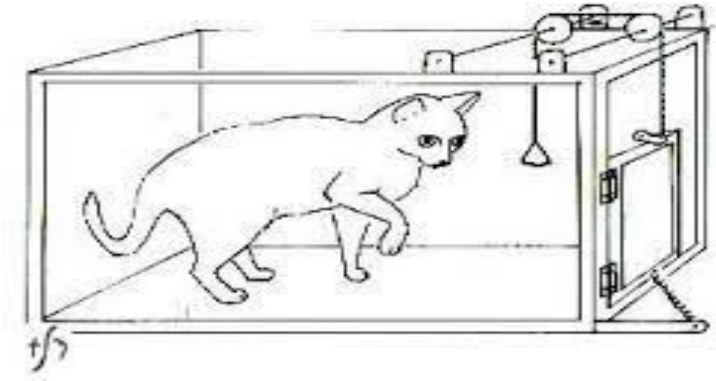
though for the study of motivation it did not start out that way.

Glued

Learning theory began ironically, not with a mouse, but with its nemesis, a cat. Near the turn of the century, the psychologist Edward Thorndike sought to understand basic incentive processes. Prior to Thorndike, incentive was due to the vagaries of experience, as defined by philosophers through introspective methods as old as Socrates. Thorndike was the first to study learning by using animals as subjects. The rudimentary processes of learning could be best explained through the rudiments of experience, and what better subjects to explore this then creatures that had rudimentary minds? The cat, of which curiosity has often the better of, was an obvious candidate. He placed a cat in a puzzle box and left just outside the box a piece of fish. He then measured the time how long it took to escape. He experimented with different ways that would enable the cat to escape the puzzle box and reach the fish. Eventually the cat would stumble upon the lever which opened the cage. When it had escaped it was put in again, and once more the time it took to escape was noted. In successive trials the cat would learn that pressing the lever would have favorable consequences and it would adopt this behavior, becoming increasingly faster at pressing the lever.

Edward Thorndike postulated a "Law of effect" which stated that any behavior that is followed by pleasant consequences is likely to be repeated, and any behavior followed by unpleasant consequences is likely to be stopped. The notion that a reward to be effective had pleasant or unpleasant entailments was later discarded as

superfluous to the predictive power of simply observing that a discrete reward had a discrete effect. Besides, inferring an affective component to reward was mainly that, an inference, and inferences ungrounded to actual neural processes opened the gateway for other 'mentalistic' events unanchored to real neurological events that could fill in the explanatory gaps for behavior. Because such inferences were at the time untestable, the danger of mentalism was demonstrated by unbridled philosophizing about behavior that created a babel of beliefs about how motivation works that are with us to this day.



Thorndike Puzzle Box

The aversion to mentalism was the justification of the philosophical position underscoring the research of the psychologist B.F. Skinner, who in the 1930's measured the physical topography or form of responses such as rate, force, and amplitude for laboratory mice and pigeons who had to press levers and peck keys under piece work schedules of reward or reinforcement not unlike those labored by many of us on production lines or other lines of work. The fact that behavior could be reliably mapped to

contingencies of reward or reinforcement demonstrated that the control of behavior could be methodologically managed and predicted. In contrast to Pavlov's S-R or stimulus-response outcome model, Skinners paradigm was exactly the reverse, or an R-S or response-stimulus outcome model. In addition, the inference was made that Skinnerian procedures exclusively described overt or voluntary behavior mediated by the striatal musculature (running, grasping, talking), whereas Pavlovian procedures described covert or involuntary behavior that were mediated by the smooth musculature (anxiety).[12] The additional inference followed that there were two distinctive learning types of respondent and operant conditioning that presumably were controlled by different neural processes.

Skinner's 'methodological behaviorism' heralded a pragmatic approach to the management and control of behavior, as behavior was shaped by the judicious timing, scale, and contingent application of reward. It was not however an explanatory account of behavior because it only mapped the correlation between behavior and schedules of reinforcement or reward and was inductive in nature (i.e. correlation proves the rule), rather than employing deductive principles that could lead to falsifiable premises. The study of operant conditioning led to its pragmatic application in personal and social affairs, or the field of 'behavior analysis', which in its heyday in the 1970's operationalized the concept of reinforcement, that humans are motivated by the prospect of tangible rewards.

From the operant perspective, the concept of reinforcement was pragmatic, not explanatory. The internal processes of how reinforcement fixed or 'glued' a response to behavior were outside of the purview of behavior analysts, whose first concern was prediction and control. The only problem

with this model was that it didn't quite work, as responding could not be reliably predicted by just mapping singular incentives to behavior, and one could learn without having to behave overtly at all, and often the application of a reinforcement event caused the opposite response, or none at all. Indeed, reinforcement does not require the actual occurrence of overt behavior but merely the activity of the neural systems that produce it, as we can learn by observation alone. But what were these processes? How does one know when it occurs or how it occurs, rather than observing the subsequent effects of reinforcement, which may only be revealed in certain times and circumstances, or perhaps never at all?

A Unified Reinforcement Principle

The three metaphorical motivational forces of pushed, pulled and glued remain well accepted by folk as well as academic psychologists for the simple reason that they represent heuristic or rule of thumb approximations that tell us how behavior generally works. This had not impeded the long and often contentious effort, continuing to this day, to justify them as representing actual forces that are rooted in corresponding regions of the brain.

One indicator of how they don't work, is how uncertainly they work together, as when they are employed concurrently to describe behavior that to an untrained eye is simple, but to the over-trained eye is needlessly complex. For example, seeing an apple elicits the unconditioned response of arousal and desire, and walking to an apple is rewarded by an apple in hand, with a subsidiary motive, embodied by hunger, which drives one faster to his goal. In this example, all three motivating processes are in action.

Does this mean that there are three separate motivational centers in the brain, vying for attention, or is there a simpler, unifying principle that does not require the separate and uncertain coordination of three disparate motivational processes that are products of inference, and not observation?

For the study of motivation, drive concepts were incorporated into the data languages of operant (Skinnerian) and respondent or classical (Pavlovian) conditioning, as response intensity, rate, and direction are modified by deprivation levels (hunger, thirst) imposed on laboratory animals. This was denoted by the S-O-R (stimulus-organism-response) model that proposed a mediating motivational entity such as drive that made the behavioral equations work. Unfortunately, there is an ad hoc quality to such intervening variables, as they cannot be anchored to real observable processes, and are ambiguously tethered to stimulus and response. The answer, as we shall see, is simply merging the O into the observable entities of stimulus and response, or in other words, by defining stimuli and responses not only in terms of their physical or abstract properties, but by how they map to actual micro-behavioral processes in individual brains. There is in other words no temporal space occupied by some mediating process that precedes or follows a stimulus or response, as the processes are incorporated in the stimulus and response themselves.

Fortunately, for the study of the rudimentary processes of learning or motivation, Skinnerian and Pavlovian procedures never outlived their usefulness, and their methodological range has been expanded due to their greater ability to map to ever refined micro-behavioral events that extend to even the 'behavior' of individual

neurons. Indeed, as in their counterpart in the physical sciences, the increasing resolving power of observational tools has brought granular or micro-behavioral aspects of behavior into view. The view that micro-behavioral events are a part of a science of behavior was termed a *radical behaviorism* by Skinner.[13] Such unobserved events are admissible so long as they are not accorded characteristics other than those observed events that have subjected to experimental analysis. The ability to observe behavior from the molar (walking, talking) to the molecular (fine grain neural processes) allowed psychologists to determine once and for all how incentive motivation works, and to create an explanation in full.

The ability to observe the physical world in its most abstract and elemental state has its virtue in demonstrating how the complex can emerge from the simple, from the human genome to the birth of stars. For incentive motivation, the ability to observe nature in its rudiments allows us to winnow down the often-baffling constellation of motivating forces to one guiding star. In the physical sciences physical and chemical processes are emergent properties of elementary physical processes. Similarly, for the study of motivation, reinforcers or incentives have been reduced to a singular governing process that is elementary and observable. This was the argument by the behaviorists John Donahoe and David Palmer in their magisterial 1994 book, 'Learning and Complex Behavior', D&P proposed that reinforcement or incentive is uniformly based on 'discrepancy' principles, where from moment to moment an organism encounters events that vary, ever slightly, from what is predicted, or an act-outcome discrepancy. This 'unified reinforcement principle' underscores all incentive or reward and can explain how all reinforcement

procedures work. As defined: "*The proposed principle of selection by reinforcement holds that whenever a behavioral discrepancy occurs, an environmental-behavior relation is selected that consists-other things being equal- of all stimuli occurring immediately before the discrepancy and all those responses occurring immediately before and after the same time of the elicited response. The principle of reinforcement makes no fundamental distinction between the selection process in the classical and operant procedure. For that reason, it has been called a unified principle of reinforcement…From the perspective of a* ***unified reinforcement principle****, classical and operant conditioning are not two different 'kinds' of learning, but two procedures that differ with respect to the environmental and behavioral events that are reliably present when selection occurs*."[14] [15]

Donahoe and Palmer's Unified Reinforcement Principle collapses the distinction between R-S (operant) and S-R (respondent) learning, or instrumental and classical conditioning. Heretofore, these types of learning represented two distinct classes or responses, with the subsequent inference that each class was reflective of a distinctive neural process. Outside of the glaring fact that separate neural processes underscoring operant and respondent conditioning have never been found, the notion of a response as a precursor (operant) or consequence (respondent) of a stimulus ignored the fact that responses are molar or aggregate representations of subgroups of molecular stimulus events. In other words, environmental events or generally defined in terms of their *individual* stimulus properties (e.g. the smell of a cake) whereas behavioral events are defined in terms of their *aggregate* stimulus properties (e.g. running as the rapid tension and flexion of muscular groups). Whether in isolate or

aggregate, each predicts specific stimulus outcomes, or expectancies. This new interpretation merges both response classes under one conceptual scheme that is cognitive in nature. In other words, all learning represents S-S* (stimulus event-stimulus outcome) relationships, or stimulus event-stimulus outcome expectancies. The novel change in S-S* relationship or behavioral discrepancy, was the locus of reinforcement, and could be operationally and neurologically defined.

As Guerra and Silva noted, *"Behavioral discrepancy appears to offer a parsimonious principle that serves both types of conditioning. Among the wide range of responses and stimuli occurring in a time continuum, the US (unconditioned stimulus) is not preceded either by stimuli or responses, but it is always preceded by both. As a result, the US-produced discrepancy selects its better correlated precedent events (i.e., environmental events in the case of classical conditioning and behavioral events in the case of operant conditioning). When stimuli reliably precede the US, classical conditioning is in effect. When responses reliably precede the US, operant conditioning occurs. In this latter case, the discriminative stimulus is also selected because of its regular presence when discrepancy occurs."* [16]

Neurologically, the anticipation of[1] or our experience with novel and positive changes of our moment-to-moment

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[1] The conscious or unconscious anticipation of novel and positive discrepancy also elicits dopaminergic activity, and is called 'priming'. Priming effects are abundant in nature, and provide an affective or behavioral bridge from the often-lengthy time from the expectation to the experience of a discrepant event. For example, a fisherman waiting patiently by his fishing pole is affectively primed by the expectation of a near future positive and novel event (a fish tugging on the line), and it may be said that 99% of his time is spent alertly or 'pleasurably' awaiting for

predictions of the world are correlated with the release of the neuro-modulator dopamine, which incorporates the classic function of a neurotransmitter with the added ability to initiate the firing of groups of neurons and increase their connectivity or 'synaptic efficacy'. The axons of dopamine neurons project from the midbrain to the cerebral cortex, and it at the cortical level that new memories are consolidated and learning occurs. Per Guerra and Silva, "*At the neural level, this relational function can be characterized by altering anatomic connections and the efficacy of synapses between sensory neurons (the stimulus pathways) and motor neurons (the response pathways). The learning history of an organism requires changes in brain anatomy and physiology because environment–behavior relations are strengthened as neural connections. Such connections would cover the temporal gaps between current learning and the later expression of learning."*[17] In other words, from a biological perspective of behavioral phenomena, reinforcement simply strengthens inter-connections among neurons, and these new connections often occur latently, and be expressed in time as observable behavior.

Donahoe and Palmer's work for the first time included neuroscience as a critical component of Skinnerian behavior analysis, though from the perspective of its current practice this has not come to pass. Indeed, a discrepancy theory of reward does not seem to suggest any new and fruitful procedures for the prediction and control of behavior, but only provides a better explanation for the efficacy of

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a positive outcome. Priming behaviors also extend to the salivary response before eating, sexual arousal before intimacy, or the muscular tension in anxiety in apprehension of a stressful event such as a test or rollercoaster ride.

procedures long known and applied. The reason for this is that reinforcement is a biochemical event that seems to have no subjective or objective manifestations. Whereas giving an individual a physical (an apple) or virtual reward (praise) can be observed and notated, moment to moment act-outcome discrepancy is a private event that has no objective or subjective manifestations, and cannot be measured, felt, or tracked, or can it?

Cause and Affect

The North Star

Motivation has a direction, a purpose, and if we deviate from its compass direction it impels us to take, we literally feel it. Our instincts tell us that much. To eat, sleep, reproduce, to seek pleasure and avoid pain are natural impulses that serve if not an evolutionary than certainly a personal end, namely ensuring our very survival. This 'teleological' argument, coming from the Greek root word of 'telos' or 'goal', means that all behavior has a purpose. To keep us on the straight and narrow, like keeping to a polar star, reason can logically suffice, but survival has little time for contemplation. To think through the advisability of placing your hand on a hot pan, when to stop strenuous exercise, or the proper timing of when to eat or sleep, cannot replace the speed and automaticity of our feelings, where reaction times are counted in heartbeats, not thoughts. In other words, to be effective, one must be *affective*. The applicability of this rule to our basic needs is self-evident, but for our higher concerns that can secure our well-being independent of the deprivations and aches and pains of the moment, affect is equally important, and as 'gut feelings' is real, but has an entirely different source.

Except for imitating and culminating events such as being hungry and eating food, the overt and covert behaviors that populate our day such as walking, talking, thinking are effective, but not considered as a rule, affective. Affect represents our rudimentary experience of sensory stimuli, from painful and pleasurable to arousing and depressing, that are separate from their cognitive interpretation. They are the elemental feelings that guide our lives. This would

seem to be confirmed in the lives of our lesser cousins in the animal world whose 'self-reports' were limited to running, jumping, eating, and other overt behaviors that could be easily observed. A mouse in other words simply didn't have feelings, and if it did, it was the afterglow of other non-affective causes. If feelings were not possible or were of marginal utility in animals the inference easily followed that cognitive, mechanistic, or computational metaphors sufficed to explain their general behavior. This confirmed and informed the modern-day cognitive interpretation of behavior that is inclined to see all psychological processes, including emotions, through a purely cognitive lens.[18] Thus to change behavior and associated feelings, cognitive events had to change first, and good feelings were consequential to rather than concurrent with changes in cognition or information.

In the first half of the twentieth century, subjective feelings were irrelevant, behavior whether in animals or humans, could be controlled through the judicious employment of outside stimuli, reward, or reinforcers. Pragmatism dictated that feelings, even if real, were outside of the equation for behavior. In the modern era, the equation is the same, feelings *are* real, but are subservient to complex and often obscure processes of reasoning and language and are the byproduct rather than driving force behind behavior. The result is that regardless of whether affect is confirmed or denied, it has remained subordinate to overarching cognitive processes that separate human experience from that of animals. Like black and white movies with just a few shades of color, motivation is garbed in the drab colors of inferred cognitive processes that make metaphors of old seem cartoonish.

The unified reinforcement principle advanced by Donahoe and Palmer would seem to be coherent with this overarching cognitive perspective that rendered affect subordinate, and merely consequential to behavior. The problem that D&P failed to address is that if reinforcement is mediated by the neuromodulator dopamine, then reinforcement must not only be effective, it must be *affective*. Donahoe and Palmer's definition of reinforcement ignored the fact that increases or decreases in dopaminergic activity respectively correspond with very perceptible sensations or feelings of energy and arousal when a predicted but not certain award occurs, or feelings of boredom, disappointment, or depression[19] when a predicted award does not occur. Dopamine release also scales or increases with the importance or salience of an anticipated event,[20] or priming, and is felt as a sense of energy, or activation, but not ironically, pleasure, and changes also the incentive value or importance of moment-to-moment behavior.[21] This momentary salience may or may not correspond to the overall importance of an extended behavior sequence. For example, the increase in dopamine activity due to intermittent small wins on a slot machine increase the salience or moment to moment importance of gambling even though the long-term consequences (namely a large cumulative loss) is the inevitable consequence. Dopamine systems are not only activated when act/outcome discrepancy is perceived, but also in anticipation of or to 'prime' an individual to sustain focus towards future anticipated positive unexpected events.[22] [23]Thus, we can do work that is completely predictable but continue performing in anticipation of a reward and its unexpected positive implications.

These omissions were addressed by the neuro-psychologist Kent Berridge in the late 1990's. In contrast to Donahoe and Palmer's concept of reinforcement as a molecular event (dopamine release at a specific point in time), Berridge reframed reinforcement or incentive as a molar event (modulation of dopaminergic activity across time) and redefined this event as the process of 'wanting'. With Berridge's research the laboratory mouse came into its own, and his findings bridged the gap between the brain structures which govern affect for humans and mammals. Using such tools as optogenetics (laser light) and drug microinjection, Berridge and his research team were able to stimulate and observe the microstructure of mammalian brains to discover new truths about incentives motivation, learning, instinctive behavior and affective reactions, and with the same level of care and ethical concern for his little subjects that Pavlov provided his animals a hundred years earlier.

The principle that all behavior is 'affective' is implicit in a dopaminergic definition of incentive. But if not pleasure but arousal is the affective component of dopamine, what role does pleasure play in motivation, and how does it interact with the arousal states that comprise moment to moment incentives?

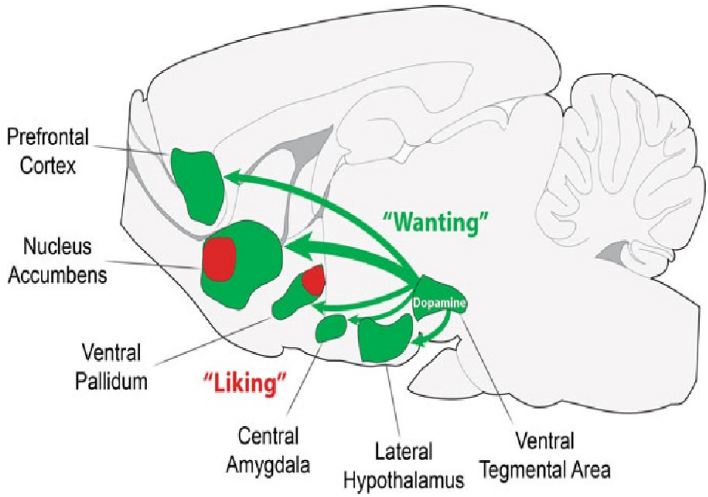
Pleasure

Dopamine systems have a robust and extensive presence in the human brain, from the midbrain centers that are the seat of affect to the cortical areas that govern memory and learning. This reflects the extensive role of these systems in governing affect, motivation, learning and even locomotion, and it has a corresponding and continuous presence as conscious and non-conscious affect. In contrast to wanting

or attentive arousal, which is mediated by dopaminergic activity, the experience of pleasure is entirely different, and is mediated by opioid systems that are located in very small areas or 'hot spots' in the mid-brain. 'Liking' is an objective process of positive hedonic reaction that underlies subjective sensory pleasure. In general, we take our pleasures at intermittent times and when the pleasure predicted to be the most intense, and in these occasions, we are much more motivated to pursue a pleasurable object. It is here that many psychologists invoke the concept of *drive*, as a person is much more likely to 'want' to consume a cake when he is in a state of deprivation. But the concept of drive is a chimera, since deprivation only enhances the incentive salience or value of an object (a cake), but motivation remains guided by dopamine systems. Thus, as Berridge noted, *"Incentive motivation theories posit that motivation is directed towards affectively positive incentives, and that brain motivation systems modulate those incentive values. Hunger, thirst, and other motivation states primarily act to enhance the incentive value of their particular reward, increasing 'wanting' and 'liking' for foods, or for water, and so, on rather than acting primarily as aversive goads*."[24] [25] In other words, the incentive value that from moment to moment is still embodied by dopaminergic activity that is induced in the moment. The problem is that being hungry, lustful, or bored are aversive conditions that are remediated by *positive* arousal states, as our enthusiasm for approaching a good meal, a willing mate, or a refreshing change of pace attests. 'Drives' in other words modify incentive value, or the importance of a future goal, rather than act as an aversive prod to behavior.

Whereas incentive salience or 'wanting' is generated by large and robust neural systems that include mesolimbic dopamine, 'liking', or the actual pleasurable impact of

reward consumption, is mediated by smaller and fragile neural systems, and is not dependent on dopamine. Although dopamine and opioid systems are activated by different stimuli and are located in different areas of the brain, they can indirectly activate each other.



'Wanting' and 'Liking' circuitry

Doe at Ease

When we last left our doe, we noted a life of wandering, or seeking, that made the uncertain certain, and providing security for at least the moment in an uncertain world. Yet actively seeking takes scarce resources, better to sit, relax, and just alertly scan the horizon, like a human vacationer at the beach looking out for an odd sea bird or passing dolphin. Pleasures are intermittent, pegged in time to a moment of satiation and contrasted with a subsequent period of increasing deprivation or sensitization. Our pleasures are in other words timed, for if not, we would eat

and drink until we proverbially if not literally explode. But one pleasure is immune to the waning and waxing cycle of desire, and that is rest, or the pleasant feeling we have when our covert muscles are inactive. The fact that the doe does not settle back unfocused in the pleasant thrall of relaxation, but stays alert and attentive while being relaxed underscores the fact that arousal is not just compatible with the pleasure of relaxation, but indeed may enhance it, and thus insure the doe's survival, even while resting on a literal bed of laurels.

It is easy to conflate arousal with pleasure; both are after all desirable in their own way. Indeed, both arousal and pleasure systems are activated by entirely different stimuli, in one case positive novelty, and in the other case consumption (eating, drinking). However, arousal *can* stimulate pleasure and vice versa in special circumstances. Indeed, the cellular groups or 'nuclei' that control pleasure and arousal are adjacent to each other in the brain, and for good reason. These respective opioid and dopaminergic neurons can activate each other, and opioids have an excitatory effect on dopamine systems and vice versa.[26,27,28,29,30] Thus, not only do opioids increase dopamine levels; but opioid activity is enhanced due to dopamine activation.

We know this from daily life, as the expectation of a delicious meal enhances the pleasure of food and tasting good food piques our arousal and interest.[31] This is used to good effect for marketers whose evocative descriptions on wine lists and menus can make a cheap wine or steak taste not only figuratively better, but literally better. A second and more subtle example of dopamine-opioid interactions is when our musculature is at a state of rest, as our example with the doe attests. Resting states elicit a 'tonic' or

continuous level of opioid release,[32] as compared to the 'phasic' or spikes in opioid activity that occurs when we consume tasty food or drink. This is self-evident in the fact that being relaxed is an inherently pleasant state that reflect the release of endogenous opioids. However, for relaxed individuals who are engaged in activities that represent persistent levels of positive act-outcome discrepancy (e.g. creative behavior, extreme sports), levels of arousal and pleasure increase and are reported as 'peak' or 'flow' experiences.[33] This has evolutionary value, as a state of relaxed alertness is the optimal state for an animal that both conserves energy yet successfully monitors an uncertain landscape. These facts lead us to redefine rest as representing not a static but a *dynamic* affective state, as the opioid systems activated in rest are always modulated by dynamic or phasic changes in dopamine systems that are induced by act-outcome discrepancies or expectancies. As we will later argue (pp. 144-155), resting states can be consciously manipulated to increase pleasure and arousal, and increase self-control and an attendant state of meaning and pleasure, or 'happiness'.

Overall, the dynamics of learning and motivation as reflected in the neurochemistries which underscore affect are governed by the information we glean from moment to moment about our changing world. Unadorned by metaphor, for animals at least motivation or incentive is clear, uniform, and above all, explanatory, and is encapsulated in how we deal with and seek uncertainty and its resolution. This requires us to think about incentive in an entirely new way.

Discrepancy Theory

In science, entire disciplines pivot on core explanations of the building blocks of nature. To a biologist, it is what DNA is. To a physicist, it is what is an atom, and to a social scientist, it is what is an incentive. However, knowing what these entities *do* is not enough, as a scientist most know also what they *are*.

For the biological and physical sciences explanation is proverbially nine tenths of the law, and the lawfulness of nature is thus constrained by the depth or level of our observations. However, for the concept of incentive, reward, or reinforcement in the social sciences, incentive is defined inductively or *operationally*, or by what it *does*. In contrast, for ethology, or the study of the behavior of animals, incentive is deduced and defined *biologically*, or from what it *is*, and these 'bio-behavioral' definitions of incentive are remarkably simple and consistent, and have been extended to human behavior by many affective neuroscientists from Jaak Panksepp to Kent Berridge.

The question is, can incentive be derived from first principles, namely how it is instantiated in the mammalian brain? And as with any explanation, can it provide easy and testable hypotheses, or is it falsifiable? As we have noted, for the motivations of animals at least, reinforcement means something different than the schemas of old. In this new perspective, reinforcement is continuous (cognitive) not discrete (glued, pushed, or pulled); affective, not logical; and is grounded to real observable neurological processes. Incentive is a moment-to-moment neuro-psychological phenomenon that has a valence and direction that continually varies in time. This 'discrepancy' theory of reward moves the locus for reinforcement to changing possibilities, not realized ones, and reward is embodied by

positive affect. Motivation begets learning as a matter of transition to new neural connections and the strengthening or weakening of old ones. Indeed, learning theories are by necessity theories of motivation, because to literally change a mind one must move a mind.

The implications of a discrepancy theory of motivation have been scarcely plumbed, for what lessons can be learned from a humble mouse when its nobler cousin as well as its much larger brain is ripe for examination as an entity apart, and when just introspection and outward observation can suffice to inductively reveal human nature? This has been the course for the entire history of the social sciences, from philosophy and psychology to economics and politics. In other words, to get somewhere in the social sciences you don't need to know how motivation, in its bare neuro-physiological rudiments, works. That's the way it has been, and that's the way it seems it always will be. Motivation is due to metaphorical agencies, from inspiration to free will to intrinsic and extrinsic motivators, with the neural mechanics that describe how incentives work absent in public discourse and academic philosophy, not because of disproof, but neglect. A neglect that is a product of a myopic incentive of its own.

The Roman Stoic philosopher Epictetus remarked that one should not be afraid of an entire ocean engulfing you, as merely a cup of water can suffice to drown you. Similarly, the daunting ocean of research and opinion of neuroscience has been scarcely encompassed by even its practitioners, let alone a lay audience, but even a layman can at least survey the possibilities of a cup of water. All areas of scientific research and discovery can make the same claim of data sets of oceanic proportions, yet this has not precluded aspects of each discipline to reach the realm of 'settled science' and to

be used to make predictions and enable procedures that allow academic and common folk alike to understand and control our physical, and in the case of psychology, mental worlds. The implications of this are as simplifying as they are far reaching, because as the diversity of our material world is derived from a simplicity of the atomic structure of the elements, so too is the diversity of motivation derived from cognitive processes as elemental.

The question is, for the human animal, can these same principles, spare as they are, apply to a unique species so wedded to language, or the metaphorical schemas that give distinctive motivation forces their reality? Our argument is that they can. In our next chapter we will demonstrate how complex incentives can be mediated through abstract cognitive 'discrepancies' as demonstrated by a simple game of cards.

Solitaire Genius

Alone

You are alone, in a spare room, with nothing but a deck of cards to keep you company. To while away the hours, you scatter them across the table and lay them out in pre-ordained patterns. A dull and predictable way of passing the time, but hardly due to the cards at all. So you change the rules. You shuffle the cards in a deck, and choose one at a time, placing the cards down that fit in the pattern, and discarding those that did not. Repeat the process from the discard pile until you either succeed or fail in your task. Now you have created as task whose goal and the steps required to achieve it are unpredictable, with every card representing a step backwards or forwards to its successful completion. You are in other words a solitary person playing solitaire.

Solitaire Confinement

Now let us assume that your success in playing solitaire is posted for all the world so see, and you see 'likes', positive

comments, and a degree of positive regard that not only inspires you, but also shapes the uncertain sub-goals you determine within the game, such as successive wins, speed in finishing a game, and ability to complete certain hands. So victory is important, but so is the style of winning. Now let us further assume that your prowess in solitaire is rewarded monetarily, with a contribution for your success to go to your 401k account, to be disbursed years from now when you retire from your solitaire confinement. In addition, your friends, who in the aggregate can hardly steer you wrong, assure you that by being arduous and persistent in your solitaire virtue, you will be rewarded in the afterlife, and get to play solitaire happily into infinity. You have achieved a pleasant, positive, and meaningful life, and you are happy.

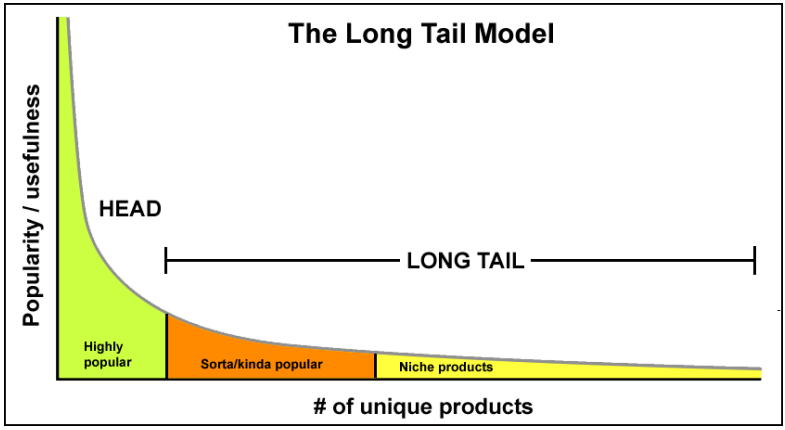
The Long Tail

"If you find yourself alone, riding in green fields with the sun on your face, do not be troubled; for you are in Elysium, and you're already dead! Brothers, what we do in life, echoes in eternity."
General Maximus Decimus Meridius motivating the troops before a battle, from the movie 'Gladiator'.

Our solitaire player not only has an interesting life, he has a *meaningful* life. We will define 'meaningful' as the branching positive implications of behavior as perceived *virtually.* And so it goes with the solitaire player, as the positive implications of his behavior branch out, it would seem, into eternity. Pleasures are ephemeral unless you have the knack of making them eternal. The significance of what we do can indeed branch out long after we are gone, and even the least accomplished of us wants a tombstone to provide a whiff of

remembrance in an eternity that in the end, despite Meridius' call, buries all.

Our ability to call to attention the slightest and unlikeliest of positive events a long ways out, and to bask in the future tense of our accomplishments long after the game is settled, represents the positive affects due to what is called a 'long tail distribution'. In statistics, a long tail is the portion of the distribution having many occurrences far from the 'peak' or central part of the distribution. The distribution could involve popularities, and occurrences of events with varying yet vanishing likelihoods. For example, Agatha Christie and Arthur Conan Doyle are among the small group of mystery writers who dominate the bulge of popular interest in detective stories, however their output is overwhelmed by the innumerable unheralded authors, published or unpublished, whose works have achieved barely a glance, or not even that.



So, given our solitaire genius' sense of pride, accomplishment, and fulfillment, what has he accomplished?

Tangibly, nothing, but virtually everything. The result of your solitary confinement is that you become a happy worker bee, even though you have received nothing, consumed nothing, and have nothing to show except for promises that in all likelihood are empty. All that you have 'consumed' are the positive prospects of uncertainty that are signaled by positive affect or the importance or decision utility of the moment. The expected utilities remain important, but that is what they are and will continue to be, *expected*.

Meaning is independent of content, and it is also independent of universal or popular regard. For a life of meaning, one does not require the broad acclaim of a Mozart or Shakespeare, who in their time were late to be well regarded, and even then, achieved only provincial fame. Indeed, meaning is a personal and private perspective, and can be local and stop quite a bit short of lasting throughout eternity. Indeed, meaning is often sought within academic, social, or professional circles which provide incentives that meet their narrow, more focused interests, and at the cost of reduction of appeal outside of them.[34] This results in individuals remaining in the orbit of the institutions from political parties to religious and social groups because of their incentive structure alone. So, whether in the broad world, or more likely in your private bubble, in this case a solitary solitaire one, you are happy, but as with all things, accomplishment is after all, quite relative, until of course you can relate to it.

Negative Contrast

When we last left our solitary genius, life was going along quite swimmingly. Life adjusted itself to his efforts with

surprising ease, acquiescing to his changing needs. Of course, fate always holds us in the balance, and is not predisposed to favor our whims, unless they are predetermined of course. We can adjust the fates in the games we play, but nature has no difficulty setting, and death, when it comes is always permanent.

Lights are bright because of their contrast with the darkness, but they can also dim and reflect the shades of grey, trending to black, that require the eye to adjust its focus. In behavior, the sunny vision of positive surprise dims when positive surprises become more infrequent, turn negative, or stop altogether. Thus, at best we become bored, and at worst suffer the pain of disappointment or depression when fortune turns south. And so too would our solitaire genius be fated if he had a losing streak, lose the attention of his followers, noted that his peers were more successful than he, or even worse, that they trumpeted that fact.

Gains and losses are not absolute but relative things. Like acceleration in Einsteinian equations, how fast you are going is not only relative to where you *were*, but where you *are*, which happens to be always moving too. Thus, you mark your acceleration relative to a moving yet 'immobile' earth at full stop, but as you gain speed you may be passing a car on the interstate at a snail's pace, even though relative to a turtle on the side of the road you are moving at high speed. If all you saw was the turtle on the road, you would be confident of your fleet footedness, but if the car on your side was passing you with the acceleration of a determined turtle, that your confidence in your superior speed would be fleeting indeed.

We continually contrast our awareness of our relative success in any endeavor, whether it be to our prior accomplishments or the accomplishments of others.[35] The

latter can represent our competitive prowess in business, or something as trivial as waiting in line. Consider standing in a grocery checkout. It is uncomfortable to get delayed in line when a register malfunctions, and often equally irritating when the line next to you moves much faster. Whether we are delayed in real time or virtual time, the relative losses we perceive are still losses. And more often than not it is the relative losses that are the most painful because they are the least controllable yet can be mitigated if we ignore or avoid them.

We do not relive the embarrassments and losses of the past but have nostalgic remembrance for the good old days when life that was indeed good and when our favorite team was always on the winning track and we got A's in all our endeavors. For our day to day lives, it is uncomfortable when others display their superiority to you, unless that is to our interest, or incentive. Thus, we submit to the greater expertise of our family doctor, lawyer, or plumber, or if we are in their occupational shoes, take pleasure that others submit to us. But this is less so when the *display* of contrasting value is apart from our or our peers' superior skills. Thus, immodest and prideful behavior in even those we respect is impolitic, because it provides contrasts that hurt. Outside of the uncomfortable feelings of envy or jealousy, there is infrequent opportunity for retaliation for this negative contrast, yet we should be inconsiderate of it at our peril if we too loudly proclaim, as did Marie Antoinette to the peasantry with the words that lost her kingdom and her head, "let them eat cake!"

Conspicuous consumption and the conscious display of status is important if we wish to effect external control to those who solicit it and is less wise for those who don't. Wiser would be striving for the inner confidence bestowed

by the covert incentives that come without obvious notice or regard, as one can take equal pleasure of being the power behind the throne, or the workplace or household for that matter.

For our solitaire player, as for all of those who play the game of life, dealing with the unpleasant elements of contrast means narrowing our vision to selected incentives, developing the skills and choosing the venues that will lead to greater incentives, avoid the situations that provide disincentives, and to keep oneself not in the dark, but away from it. How we develop and manage our incentives depends not only in defining them, but in how we time them and validate them, which we will argue represents an instinctive penchant for risk as well as delusion. That, as we will discuss in a later chapter, is a matter of the imperfect science of self-control.

Conflict

Our solitaire genius is home, but not quite home alone. Indeed, the very medium that allows him to play solitaire is a cornucopia of delights. During the day, he can be diverted from his work to check email, stream movies and sporting events, chat with friends, check social media, and more. In addition, he can be interrupted by friends, family or co-workers through social media, phone calls, or email. He can also dwell on past poor choices (guilt) and difficult future ones (rumination). He is in other words distracted by events past, present, and future, and often he gets very tense and even anxious about it. In other words, he cannot make up his mind, thus causing him to lose his mind.

Whether he will continue his game while in a state of painful indecision is not due to the lack or availability of

incentives and the act-outcome discrepancies they denote, but to a different type of motivator, actual physical discomfort. Since the resolution of indecision to eliminate this pain is usually difficult or impossible, avoidance is a better route, but whether he escapes from his situation or accepts it, his success in his solitaire life is impaired by stress.

A Matter of Stress

In folk and academic psychology, stress has myriad definitions. Here we will start with its standard version, that it represents sustained neuro-muscular activation or tension and the cascading effects or changes in the autonomic nervous system that it initiates.[36] Covert neuro-muscular activity or tension is an outlier in learning theories for the simple reason that the affective counterpart of stress does not directly originate in the modulation of neurotransmitter activity, as in dopamine and opioid systems, but rather in the sustained activity of the musculature, the pain it causes, how it effects the body, or the stress response.[37] Pain is a different type of motivator, and although also dependent upon neurotransmitter activity, its instigator is not passive cognition, but physical action, or the activity of the covert musculature. The latter is also mediated by incentive, thus making stress indirectly dependent upon how incentives are perceived and arranged.

Decisions have consequences, some major, some minor, some intermittent, some persistent, and our feelings map to them every step of the way. In the 1950's, the psychologists John Dollard and Neal Miller recognized this, and in their experiments with laboratory animals demonstrated that tension or anxiety was elicited when an animal was placed in circumstances where one decision caused the loss of an another equally important alternative. As students of Clark Hull, and in keeping with Hullian principles, they inferred that anxiety acted as a 'drive' to force the animal to make one decision or another or avoid the situation entire. The Dollard and Miller hypothesis of the 'drive' of anxiety[38] has been called into question, but their observations have not.

Indeed, their findings have been extended to include the full range of cognitive operations that frame mental events situated from past to future. Shorn of its theoretical aspects of drive, the observation that covert muscular tension occurs upon indecision between two equal or incommensurable decisions is called the 'perseverative cognition hypothesis'.[39] [40]Perseverative cognition means that sustained thinking about incompatible decisions in the past (guilt), present (distraction) or future (worry) are far more harmful to us than the more intense yet transient stressors that come and go. The sustained and unrelieved activation of the musculature taxes our physiology and results in pain and exhaustion. This form of stress, which is not to be confused with fear,[41] populates our days, and because it is dependent upon the timing and probability of consequential informational events and alters the course of behavior, is a learned response.[42] For example, anxiety occurs when there is a possibility of making a correct choice. When there is not, a state of depression is likely instead. Thus, tension occurs because it modulates responding or choice behavior, whereas depression does not.

According to the perseveration cognition hypothesis, tension or stress most commonly occurs when it is *consistent and slight*, not when it is intermittent and intense. This type of stress is often near imperceptible or is non-consciously perceived yet causes continued activation of the autonomic nervous system even after perseveration ceases. Because there is no time for recovery between stressful events, *"perseverative cognition moderates the health consequences of stressors because it can prolong stress-related affective and physiological activation, both in advance of and following the occurrence of stressors*." [43] To understand how imperceptible conflicts or stressors can cause exhaustion and ill health, one

must first understand the namesake of the condition involved, namely a beloved fairy tale character.

Cinderella and her effects

In the fairy tale, Cinderella faced daily exhaustion through having to pursue innumerable small tasks heaped upon her by her stepsisters and evil stepmother, with each task having the same high priority, resulting in lots of continuous dilemmas and resulting stress. Although the demands were not great, it was the continuous indecisions that hurt. In Cinderella's case and in the real world, sustained levels of muscular tension are commonly produced during continuous moment to moment alternative choices wherein any choice entails near equivalent feasible or avoidable losses, or dilemmas. These dilemmas may consist of two or more rationally comparable choices that are near equivalent (e.g. what choice to make in a card game) or two choices that represent affective choices or affective vs. rational choices that are near equivalent in value and cannot be logically compared.[44] An affective choice will be defined as anticipatory positive affect or more specifically, a priming effect due to the enhanced and sustained activity of mid-brain dopamine systems[45] that provide an affective value (or 'wanting') to engaging in or the prospect of engaging in positive unpredicted or novel events (e.g. checking email) or primary drives (e.g. 'wanting' an ice cream cone). As such this activity may occur not only when a discrepancy is perceived but also from moment to moment *prior* to or in anticipation of that event. Thus, continuous decision making between alternative choices (e.g. doing housework or minding a child, working or surfing the internet, staying on a diet or

eating ice cream, keeping a dental appointment or staying at home) represents irreconcilable affective and/or rational alternatives wherein one choice entails the loss of its alternative, and is associated with sustained or tonic levels of tension that is painful. This 'Cinderella Effect', [46] [47] [48] [49] represents the continuous activation of 'slow twitch muscular units' (also called Cinderella fibers). This sustained activation causes them to eventually fail, and thus recruit other groups of muscles more peripheral to the original group, resulting in pain and exhaustion. In addition, these slow twitch fibers are slow to deactivate, and will continue activated even during subsequent intervals of rest.[50] The aversive result of this long-term activation conforms to the concept of 'allostatic load',[51] which predicts that tension and arousal will be maladaptive when there is an imbalance between activation and rest/recovery. Specifically, continuous low level or 'slight' tension results in overexposure to stress hormones, high blood pressure, and resulting mental and physical exhaustion.

Overall, slight tension is correlated with momentary choices between alternatives that have *low* salience and are characteristic of common day to day choices that are often non-consciously perceived. However, if the choice salience was very high, wherein alternative choices represent highly salient possible outcomes such as matters of life and death, then tension and arousal would be much higher, and would be reported as anxiety.[52] The redeeming characteristic of the Cinderella Effect is that unlike other stressors that are hard to predict and control, the Cinderella stressors are often slight and are very controllable, if of course we have a mind to understanding how they work and what they do.

The Colors of Affect

Positive and negative discrepancies as characterized by the successes and failures of our solitaire player represent affective states that vary in degree and are mediated by changes in neuro-transmitter levels, specifically dopamine and opioid systems. Thus, dopaminergic activity can be high when one perceives moment to moment positive discrepancy (e.g. the excitement of winning a game), or low when moment to moment discrepancy is negative (e.g. depression due to losing a game), and all with a few detours along the way by behavior modulated by the sensitivities or 'drives' which give us pause to eat, drink, or have a romantic interlude. Similarly, one can be in pain or pleasure due to covert neuro-muscular activity or inactivity attributable to learning, a pain due to the slings and arrows of not so much outrageous as irritating fortune.

The permutations of pain and pleasure and how they are influenced by stimuli both external (as in chilly day) or internal (internal sensitivities or drives, or agents of disease) can seem to be a daunting challenge to understand, let alone derive from first principles. But this is not the case. As an example, to take the measure of all the colors in the world, all we need to do is to account for three primary colors, red, yellow, and blue. Intermix their shades within the axis of a wheel, and you can generate a rainbow of colors of every shade and hue. This makes it easy to understand where color comes from in all its bounteous diversity and how its generation is dependent upon the simple manipulation of three primary colors. In the next chapter, we will demonstrate how affect in all its wide manifestations can indeed by mapped to the primary colors or abstract properties of information, and how they can be used in the prediction and control of behavior.

Emotion

"What's in a name? That which we call a rose by any other name would smell as sweet"

Romeo and Juliet, Shakespeare

Affect and Information

Taste a ripe apple, smell a rose, or just have a headache after a hard day at the office, and your interpretations of the experience often take flight, and a similar physiological experience can become linguistically separate and unique. Affect and its contextual interpretations represent our emotions, and they are as prolix and profound as our imaginations can make them. We are emotional animals, but by any other names would our basic affective response smell, taste, and otherwise feel the same? This question is addressed by the subfield of brain science called affective neuroscience. Affective neuroscience is the study of the neurological underpinnings of affect, or the sensate attributes of arousal, pleasure and pain that comprise how we feel. Affect however is not a passive or intermittent thing but is actively involved in how we are motivated and how we learn. Above all, affect is not separate from behavior, but is an aspect *of* behavior.

Affect is elicited by external *stimulus events* that bring about the pleasures and pains of life, from the aches and pains of impinging stimuli from cold to heat to a stubbed foot, to the pleasures of food and drink, to fighting disease and achieving wellness. Affect also occurs through the indirect action of consciously or non-consciously perceived

informative events[53] or expectancies that corresponds to the act-outcome discrepancies that elicit attentive arousal and in their absence depression. Expectancies also indirectly elicit affect through their activation of covert neuro-muscular behavior or its reduction (muscular tension, relaxation), which influence and guide decision making and are painful or pleasurable.

For the concept of emotion and the affective events from which emotions are derived, the predominant perspective in psychology maps the cognitive source of emotion to *normative* properties of information, or the *contents* of experience as consciously perceived. In this perspective, emotions are dependent upon context, and are defined by what they *do* rather than what they *are*. In other words, emotion is a taxonomy or categorization for causes that tells us the direction and value of behavior. Thus, to say that one is compassionate, sincere, humble, or proud represents not only affective states, but the general nature of events (giving alms, taking credit, being honest, etc.) that makes us feel the way we do. Here a different view is argued that emotion is elicited by *abstract* properties of information (contrast, conflict, incentive salience). This analysis derives information from structural aspects of experience that in turn can be schematically depicted through a 'circumplex' model that plots affect to correlations of rudimentary informative events.[54] Surprisingly, this interpretation is not new, but forms the basis of the very first interpretation of emotion over 120 years ago.

For Wundt and a Better Explanation

To make reliable conclusions, one must first make reliable observations, and if instrumentalities are not available, one must have an unerring eye. That was Galileo's approach, and he made his intellectual mark by using a new prosthetic device which greatly empowered the human eye, namely the telescope, a new invention that he improved upon and used to overturn the established view, both metaphorically and literally, of the world. The physical and biological sciences had the jump on the science of the mind from progressively accurate observations due to the availability of constantly improving instrumentalities for observation, a trend line that has continued to accelerate in this era.

In 1897, an observer of the human condition made his mark as an observer of behavior as meticulous as Galileo, but without the psychological equivalent of even a magnifying glass. Wilhelm Wundt, the founding father of experimental psychology, was among the first psychologists to insist upon precise observation that could be replicated across individual subjects within the same experimental setting.[55] Wundt recognized that behavior parallels and is initiated by how individuals feel, or their affective state. Since he did not have the observational tools to precisely measure affect, he endeavored instead to have his subjects precisely report how they felt, unencumbered by interpretation or context. This internal observation, or what Wundt called 'introspection', was construed to be consistent among individuals within certain simple experimental frameworks, such as problem solving, gauging reaction times to auditory stimuli, and the like. In addition, Wundt adopted the notion that mind and matter are not two different things that are independent, but two different ways of looking at the same thing that must not be

confounded. In the philosophy of mind, this was the concept of psychophysical parallelism that held that mental and bodily events are perfectly coordinated, without any causal interaction between them. As such, it affirms the correlation of mental and bodily events (since it accepts that when a mental event occurs, a corresponding physical effect occurs as well), but denies a direct cause and effect relation between the concept of mind as metaphorically conceived and the physical body as objectively rendered. The concept of a precise mapping of a data language (syntax) to real and observable facts (semantics) is of course the language of science. In this view, mental and bodily phenomena are independent yet inseparable, like two sides of a coin.

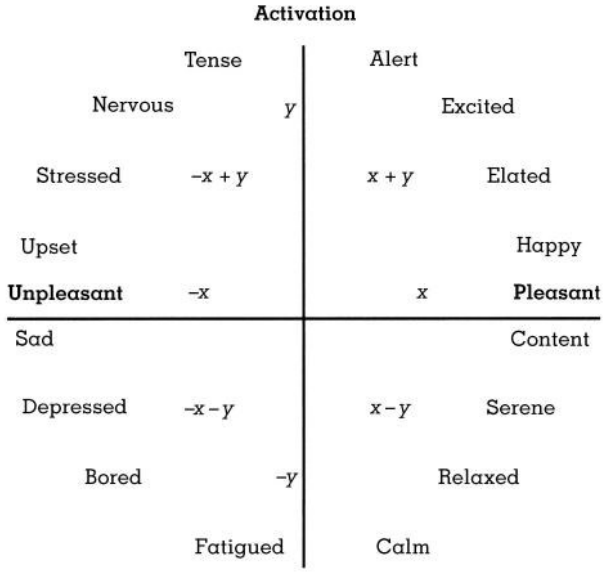
From the introspections of his subjects, Wundt proposed a dimensional scheme for affect to denote three primary affective states. According to Wundt: "*In this manifold of feelings… it is nevertheless possible to distinguish certain different chief directions, including certain affective opposites of predominant character*." [56] Wundt identified three bipolar dimensions: (i) pleasurable versus un-pleasurable, (ii) arousing versus subduing, and (iii) strain versus relaxation. Pleasure/pain, arousal/depression, tension/relaxation precisely reflect the three axes of affect that are core to our perspective on incentive motivation. From our analysis so far, these affective states may be mapped to the activity of opioid (pleasure), dopaminergic (arousal), and neuro-muscular (strain) systems, which may in turn be mapped to information as reflected by act-outcome contingencies or expectancies. "*Wundt proposed that these dimensions laid the foundation for emotional experience. Despite subsequent research inspired by many of Wundt's ideas, his theory of affect had lain dormant for a century. True to his physiological training (but in contrast to his competitor and contemporary William James),*

Wundt assumed that affect originated in the brain as well as the peripheral body. Thus, Wundt implicitly rued the lack of technology that might allow him to track neural activity and correlate it with affect when he stated: "Which central regions are thus affected we do not know. But…the physiological substrata for all the elements of our psychological experience are probably to be found in the cerebral cortex…"[57]

Wundt's analysis was prescient, and foreshadows later findings that distinguish between the neural opioid systems that modulate physical pleasure or 'liking', the dopaminergic systems that modulate attentive arousal or 'wanting'[58], and those that modulate autonomic arousal and opioid activity as respectively elicited by muscular tension and relaxation. Emotions in other words could be spun from first principles, like the motions of a ball from an algebraic cipher, or the colors of an artist's pallet from an admixture of three primary colors. Knowing how colors are derived from the primary colors of red, green, and blue give you the color wheel, where every shade and hue can be derived from these basic colors. Similarly, Wundt's observation found illustration in 'circumplex' descriptions of emotion, wherein diverse emotional states are derived from the distinctive subjective aspect of experience, or its 'qualia'. As a modern-day example of this, the Feldman Barrett and Russell emotional circumplex maps emotional states such as elation, tension, boredom etc. to the intersection of concurrent primary arousal states that move on the subjective axes from unpleasant to pleasant and activation to deactivation.[59]

The problem with this emotional circumplex, as with the color wheel, is that they provide no explanation for arousal or color. So just as mapping color requires explaining color as a function of aspects of different wavelengths of light, so

too does a description of primary arousal states require them to be explained, or in other words, described not just subjectively, but objectively, and refer to actual neuro-biological processes. The Feldman Barrett and Russell model maps the subjective and not objective correlates of emotional experience and does not map out the informative characteristics of the 'demand' that elicits these responses. It is this independent measure of information, in addition to the dependent measure of arousal that must be defined. Doing so can provide the bases for an explanatory model for the states of arousal processes that comprise emotions that we argue are based upon the mundane events that comprise daily experience.



[a] The letters x and y represent semantic components of core affect: x = pleasantness; y = activation (Feldman Barrett & Russell, 1998).

The cognitive representations of our day-to-day activities primarily involve decision making between multiple

exclusive alternatives under varying degrees of uncertainty. These '*core appraisals'* represent moment to moment changes in the abstract (uncertainty) and functional properties (utility) of environmental contingencies that are consciously or non-consciously perceived. Parallel somatic (tension and autonomic arousal), pleasurable (opioid release due to relaxation) and activating or 'energizing' (enhanced activity of dopamine neurons) events strongly correlate with specific permutations of these core appraisals and are 'painful' or 'pleasurable' in nature. These changes alter the importance or salience of a momentary response option and as an additive function create emergent emotional states.
The cognitive variables of *conflict* and *discrepancy* can be observed to respectively correlate with tension and activation or alertness (as defined by its neurological correspondence with the increased activity of mid-brain dopamine systems).[60] In addition, the degree of contrast, discrepancy, and the predicted utility of moment to moment responding in combination correlate with the level of tension and activation, and in their various permutations correspond with subjective emotional states.

As defined:

Conflict reflects the comparative value of two alternative means-end expectancies or response contingencies.

Discrepancy reflects moment to moment unexpected positive and negative variances in the immediate predicted outcome of a behavior.

Predicted Utility reflects the value of a moment-to-moment response as determined by long term hedonic (e.g. food, sex, etc.) or rational value (e.g. monetary reward).

Incentive salience reflects the relative importance of moment to moment responding under a response contingency due to the expected utility of a response and to affective responses elicited by concurrently perceived discrepancy, or decision utility.

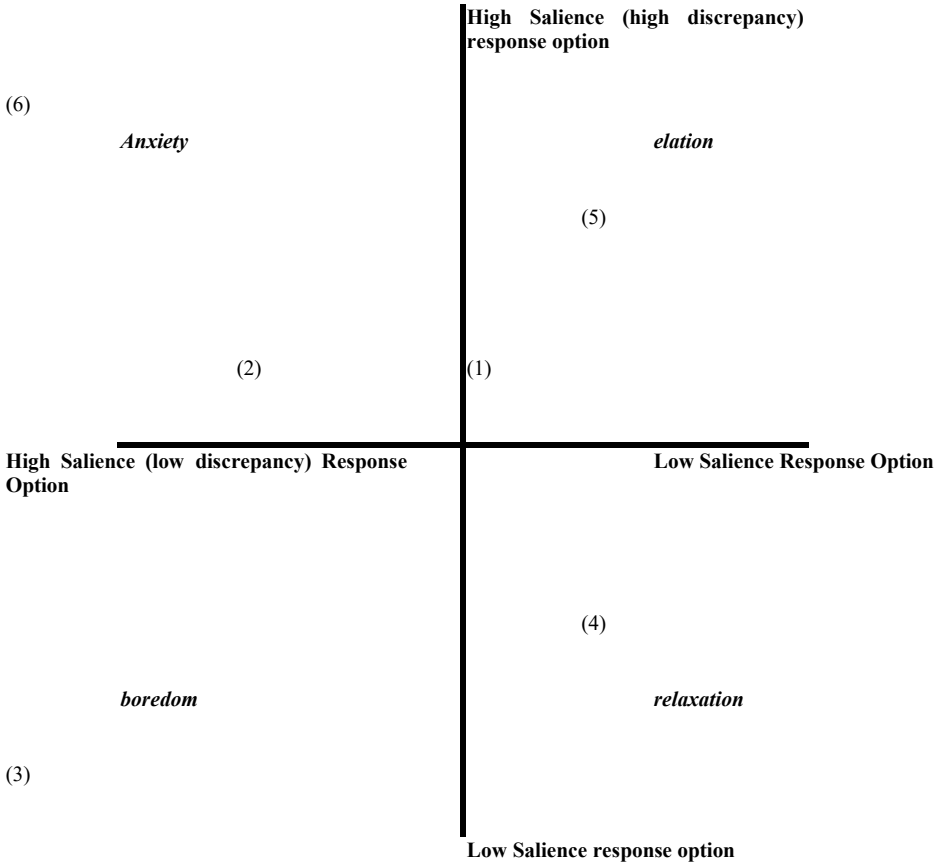
If there is a conflict between two alternative response contingencies of equal utility under certainty (i.e., little or no discrepancy in moment-to-moment act-outcome relationships), tension will occur, but the level of tension will vary with the predicted utility of a moment-to-moment response. Thus, tension will be less for low-utility choices than high. As these contingencies diverge in value, we make rational decisions to choose one of the alternatives and progressively less tension will occur. Thus, the choice between two conflicting low value alternatives (e.g. what dessert to order in a restaurant) will result in lower tension than a choice between two conflicting high value alternatives (e.g. what medical procedure to choose to treat a life-threatening condition). In addition, less tension will occur when more information is available that leads to one choice becoming more logically compelling.
The increase in dopaminergic activity due to moment-to-moment discrepancy adds another variable that increases not only the incentive salience of moment to moment responding, but also alertness (i.e., sensorimotor activation) and affective tone (i.e., a good or bad feeling). Dopamine induced activation also scales with the qualitative or informative aspects of discrepancy.[61] For example, tasks

that entail moment to moment positive discrepancy (e.g. creative behavior, sporting activities, surfing the web, etc.) under circumstances wherein the incentive salience of alternative responses is relatively low will correlate with feelings of alertness/activation or attentive arousal *and* low or non-existent tension (or low degree of discomfort or a pleasant feeling). Tasks that entail a moment-to-moment positive discrepancy wherein the incentive salience of alternative responses is relatively high will correlate with feelings of arousal *and* high and/or constant tension (or high discomfort or pain). These feelings will also increase as the utility of a response increases, or in other words, we become more alert as the 'stakes' increase, and less alert as they decrease. As the incentive salience of alternative responses increases to match the increasing salience of a primary response, the level of tension and corresponding autonomic activation will increase as well and result in a state of anxiety. Correspondingly, if the salience of a response increases as the salience of an alternative response decreases, tension will fall and activation will increase, resulting in a state of elation or ecstasy due to the combined activity of opioid (due to relaxation) and dopamine systems (due to act-outcome discrepancy).

For example, moment to moment positive discrepancy in high value sporting or creative events (e.g., a 'flow' response)[62] is marked by a feeling of energy, or 'elation' and corresponding low tension induced autonomic arousal or 'coolness under pressure' and accompanying pleasure when the salience of contrasting response options is low. However, as the salience of these options increase in value, tension becomes progressively more likely to occur both in persistence and intensity until activation and tension are continual and high, or in other words, we become anxious

or stressed. In addition, as the salience of both primary and alternative response options *decreases*, activation decreases along with muscular tension, and we feel pleasurably relaxed. Finally, a predictable response option that is highly salient due primarily to its high predicted utility and contrasts with low value alternatives will often be reported as a boring or depressing experience if activation is not high enough (as embodied by the under stimulation of the dopamine system) to energize one to "want" to perform an action that is ultimately valuable (e.g. working under a piece work schedule of reward such as in an assembly line).

To illustrate how affect dynamically changes over time as a function of information and discrepancy, consider the hypothetical example of a worker in a home office (Figure 1). Waking up in the morning and accessing email, the daily news, social network postings, etc. correlates with a feeling of pleasantness (1). However, as the morning progresses, this behavior begins to conflict with other equally salient response options (her work), correlating with sustained tension (2). If these 'distractive' choices continue, the musculature will soon fatigue and be replaced by other muscular groups, creating muscular pain and a feeling of exhaustion at the end of the day. If the worker begins to cold call clients with little or no response, then she will quickly become bored (3), and may also become depressed when she recognizes that her lack of activation forestalls her obtaining her long-term goals. Taking a time out from her duties by sitting quietly and barring distractive thoughts will result in relaxation (4). If she is completing a project to meet a deadline "just in time", then she will feel pleasantly alert (5). If she falls behind her task and/or is distracted by other pressing matters and thus perceives alternative irreconcilable choices or dilemmas, she will feel anxious (6).



Behavioral Circumplex Model of Emotion

Emotion as a Conceptual Act

This model assumes that emotional states are additive functions of separate somatic and neurological events (tension, opioid and dopamine activity) that are highly correlated with different informative or cognitive causes (contrast, discrepancy) that are abstract properties of response contingencies. The model conforms to the

Conceptual Act Model of emotion that suggests that "*these emotions (often called 'basic emotions') are not biologically hardwired, but instead, are phenomena that emerge in consciousness 'in the moment," from two more fundamental entities: core affect and categorization*" (Wikipedia). Per this model, "*core affect is a pre-conceptual primitive process, a neuro-physiological state, accessible to consciousness as a simple non-reflective feeling: feeling good or bad, feeling lethargic or energized*."[63] "*Core affect is characterized as the constant stream of transient alterations in an organism's neuro-physiological state that represents its immediate relationship to the flow of changing events*…." The Conceptual Act Model allows for the existence of processes that are biologically given but whose content must be learned. It considers affect as a core feature of all aspects of human psychology. Third, it relies on a situated conceptualization view of conceptual knowledge. The conceptual knowledge that is called forth to categorize affect is tailored to the immediate situation, acquired from prior experience, and supported by language."[64] Ultimately, the difference between both models is a matter not of theory, but of semantics. Namely, with the Conceptual Act model, core affect has no clear specific or objective referent. In other words, the neuro-physiological concomitants of pain/pleasure, lethargy/energy and the elemental informative or cognitive events that correlate with these processes are not clearly defined nor are they clearly mapped to information as denoted by the flow of changing events. As a solution to this problem, high and pronounced tension and autonomic arousal are posited to represent an unpleasant state, and profound relaxation represents a pleasant state. Similarly, the high and persistent activation of dopamine systems is related to high activation and alertness, and conversely low activation of dopamine

systems is related to low activation and low alertness or boredom. The graphical representation of this model parallels 'circumplex' models of affect[65] that posit that emotions are additive functions of separate affective processes that are mediated by separate causes (Figure 2).[66] [67]

By establishing a clear definition of the components of affect through the clarification of their abstract cognitive or informative antecedents, neuro-physiological content, and informative consequences, the circumplex model is transformed from a descriptive account of emotion to a *predictive* account that allows behavior and affect to be clearly defined and reliably mapped to simple patterns of information that in turn denotes act-outcomes relationships or behavioral contingencies. In other words, emotions are *behavioral*, and can be described and manipulated through the simple arrangement of response contingencies. By taking the full measure of behavior in all its affective manifestations as mapped to the abstract properties of the personal and social environments that induce it, we can finally take a different yet complementary measure of man that is simple to understand, comprehensive in its insights, and above all productive of useful procedures that can validate and falsify its premises. Like the best theories in science, from Darwin to Pasteur to Einstein, it is built to be explanatory, useful, and subject to criticism and easy test.

Nonetheless, unlike their mammalian brethren, for the human mammal most popular and academic perspectives on motivation brook no criticism at all because they cannot at root *be* criticized, seeing that human nature is at root disorderly and downright ornery. This is more a matter of faith than reality, but faith to many is all that matters and

all that works, until of course it bumps up against reality, and fatalism is the only recourse when motivation falters or goes awry.

The Motivation Within

Obscurantism

If motivation is not unknowable, for human beings it most certainly is obscure. That is, for humans incentives are not indefinable; they are just incomprehensible. The reasons for this are legion, from adducing behavior to spiritual otherworldly causes like the incantation of a faith healer or the motivational speaker who just impugns you to keep the faith. It can also be due to an uncritical acceptance of erudite sounding explanations from the metaphysical to the neurological that are difficult to understand, and near impossible to test.[68]

Obscurantism exalts knowledge gained by inspiration, revelation, faith, or incantation and is an anti-scientific strategy because it denies or ignores the usefulness of criticism and test. [69] It is in other words, akin to magic, but like magic, it is dispelled by explanations that beget better procedures, and there is no better way to understand this than from an examination of a magicians craft.

Motivation as Magic

In a magician's bag of tricks, the magician fixes the audience on one cause and one effect, namely a rabbit pulled out of a hat, but hides in plain sight other causes (rabbit up his sleeve, trap door in hat, etc.) that he manages to obscure by deflecting our attention through the wave of a wand or through sleight of hand. In his act, he asks us to accept two realities, one familiar and the other obscure. On one side of the equation is the physics of everyday objects such as

rabbits, hats, and wands, and on the other side is the physics of the not so explicable which makes rabbits pop out of nowhere, or the magic. The magician does not tell you how he performed his trick, and you might not rightly care, knowing after all that there must be some method to his madness. And madness is indeed what we call behaviors from magic acts to magical thinking that are inexplicable and without a cause or a purpose.

Now you see it…

In folk psychology, the psychology of everyday motivation is simple. On one hand are the extrinsic motivators that we all agree on and all see, from food to sex to money and power. On the other hand are the intrinsic motivators from free will to needs for achievement, security, self-actualization etc. that can explain why the effect of extrinsic motivators usually deviates from what we anticipate, and either works too well, sets us off in different or oppositive directions, or works not at all. Like the magician's act, we assume that there is a logical explanation behind all of this,

somewhere, but we are not likely to care. After all, the magician is a master of ceremonies, and in our everyday world it is ceremonial that we at least listen to the expert, from economists, politicians and pundits to our local preacher or mother-in-law, who at least seem to know it all, even if they are not telling us how.

And we can know all this without knowing all there is to know, a curious state of affairs when contrasted to the hard sciences where knowing all there is to know fits metaphors both simple and profound. In the physical and biological worlds, nature brooks no secrets, and even a child can understand the metaphors that describe the world. In the physical and biological sciences, objects in the large emerge from objects in the small, and the things we see from planets to plants emerge from events molecular and microscopic. We see this need to engage the metaphors of the large and how they emerge from the small in all the sciences except the one which is most personal to us, psychology. For the psychology of motivation, the idea that metaphorical motivational constructs reflect actual albeit obscure mental processes without the need to map or even attempt to map them to actual neurological processes is false in its face because that reality has not been demonstrated. Inferences do not make for reality but must be tested to see if they correspond or point *to* reality. This was and is the agenda of learning theorists from Pavlov to Berridge. As we have noted, for the psychologists who studied the motivational processes of animals, the motivational constructs of internal drives and operant and respondent conditioning have coalesced into single factor or unified reinforcement principles that logically should at least inform if not correspond to how motivation works in humans.

Intrinsic and Extrinsic Incentives

Unfortunately, even in present times, the separate and obscurely conceived metaphors that describe human motivation have resurrected the same models of motivation long discarded for animals. In particular, the concept of *extrinsic* and *intrinsic* motivation, commonly used in the fields of education, social and individual psychology returns to the metaphor of affectively experienced motives that push us forward (needs or drives) and motives that are glued to behavior (reinforcers). Thus, as defined by Deci and Ryan: "*Extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome. Extrinsic motivation thus contrasts with intrinsic motivation, which refers to doing an activity simply for the enjoyment of the activity itself, rather than its instrumental value*."[70]

Thus, according to this perspective, an extrinsic motivator is a *discrete* event that follows a set of behaviors that it rewards and is *not* affective, whereas an intrinsic motivator is an *indiscrete* event with no end in mind that occurs within a behavior set and *is* affective. This concept not only leads to the inference that intrinsic and extrinsic rewards are reflections of separate mental or neural processes, but also to the notion that these processes influence each other, with extrinsic rewards even reducing intrinsic motivation.[71] How these intrinsic and extrinsic rewards are instantiated in the brain is a question that is generally begged in all of this,[72] except for the fact that motivation is at root inscrutable, an obscurantist perspective that is fodder for an abundance of political, religious, and economic posturing that plagues us to this day. From our perspective the solution is simply a matter of changing perspective, from third person to first, and simply define not what we see, but what we demand.

Actors and Agencies

For any model of motivation, there is an actor, or the person who is receiving the incentive, and there is an agency, or the individual who is imposing the incentive. Incentives mediate expectancies or the relative likelihoods of future events, such as money mediating the expectancies of what it can buy. These expectancies may be explicit or implicit. Explicit expectancies are declarative, known by actor and agency, whereas implicit expectancies are inferred, known by the agent alone, and arranged by parties (implied or hidden agencies) or circumstances unknown by the agency but expected by the individual through prior experience. Because explicit agencies are singular and implicit agencies are generally plural, explicit expectancies and implicit expectancies are also respectively perceived as singular or plural. These are metaphorically represented by the notions of 'extrinsic' and 'intrinsic' motivation or reward. From our earlier analysis, these expectancies are *always* affective, and map to the positive and negative likelihood or discrepancies that we expect to change from moment to moment.

The fact that incentives are affective, that affect shares the same neurological attributes across different *kinds* of performance, from the practical to the spiritual, and that explicit and implicit expectancies reflect shared or unshared knowledge rather than a specific type *of* knowledge means that separate intrinsic and extrinsic motivational entities cannot exist, as both reflect the *same* neurological processes. Ultimately the distinction between intrinsic and extrinsic motivation is a linguistic fabrication that has no basis in the neurobiological reality of incentive motivation.

To illustrate, in the example of the magician, the lack of an audience's foreknowledge of how he performed his trick does not mean there is a lack of knowledge. The knowledge after all was in the possession of the magician all along. It was just that the information was not shared with the audience but was deliberately obscured. Similarly, a patron may offer a commission for an artist to complete a work of art, but the patron's lack of foreknowledge does not mean that the artist's incentives are unknown. Quite the contrary, as the artist is fully aware of them, and can derive them from the nature of the extrinsic motivator and the context in which occurs. Indeed, expectancies are embedded in the context of how extrinsic rewards are presented, and the content of these expectancies can determine what the agent can expect from the agency, and how the agent 'feels' about it.

Consider the paragon of a supreme genius whose incentives to create were to a fault, extrinsic. From his earliest operas and church music to his concertos and symphonies, to the final requiem composed as he was dying, Wolfgang Amadeus Mozart was an artist for hire, and he was commissioned from childhood to perform for prelates, commoners, courtesans, and kings. On the same status as the livery or servant class, he was enjoined to create music that both edified and entertained, and as such his art was universally employed from parties to cathedrals to the concert hall, and was as useful, universal, and disposable as a table fork.

Although Mozart's incentives were on the surface monetary, much was expected in return. Thus, a commission for an opera by the Austrian national theater was not for any minor entertainment, but for a work that reflected the many incentives Mozart already perceived.

The opera had to appeal to monarch and audience, be tasteful and tuneful, and have import to succeeding audiences who repaid the author in money and adulation. In other words, Mozart's compensation was for *qualitative* aspects of performance, qualities of his work that even without monetary compensation would have been rewarding to the composer, albeit 'intrinsically'. But the qualitative aspect of performance could have gone unenhanced or could even cut against the grain of his intrinsic incentives for such a work if the Emperor commanded the commissioned opera be sung in Turkish, as Mozart suggested for his Turkish themed opera in the film 'Amadeus'. In this case Mozart's private incentives or 'intrinsic motivation' would not have been diminished by a bizarre demand from the emperor, but just subordinated to a more important if discordant incentive.

In the case of Mozart or any individual receiving a physical (e.g., money) or virtual extrinsic (e.g., praise) incentive, that incentive has discriminative or cognitive properties, or in other words, it mediates expectancies. Likewise, extrinsic rewards are discriminative stimuli and mediate expectancies that are understood by actor and agency. Thus the emperor did not have to tell Mozart what was expected from him upon receiving his commission, as the expectancies were common knowledge.

It is when common knowledge between actor and agency is not fully available that intrinsic incentives are inferred, with an attendant reality that is difficult to disprove. But how does one know for certain how extrinsic rewards are effective, even when information is fully shared?

Between a Rock and a Hard Place

A lever moves a rock because an individual uses force, but if the individual is not observed, then to uninformed observers the causality moves to the rock itself. The ability to observe the individual and quantify the force he imparts to the lever allows the observer to quantify and apply various levels of force to make verifiable predictions, and by doing so reduces the necessity to impute self-moving characteristics to the rock that it does not have. But the rock still has mass, weight, incline and angle, and these also must be part of the calculus for the observer's predictions of how much pressure it will take to make the rock move and predict where it will go.

All behavior is leveraged by our conscious and nonconscious perceptions in the moment, but if these extrinsic events are caught in a shadow, with their cognitive manifestations hidden, then motivation moves to the individual and is often characterized by untestable intrinsic forces. But as we have noted, intrinsic motivating processes occur too, and the question for the psychologist is how to apportion causality to the right end of the equation, to the man and the lever or to the rock itself. In other words, all motivation is sourced to extrinsic events and realized by intrinsic processes, but where does one start and the other begin? This is the difficulty attendant with understanding how motivation works.

Discrepancy theories move causality to abstract, observable, and manipulable cognitive elements of the environment, namely act-outcome discrepancy. Like the man with the lever who can adjust his grip, force, and inclination, these elements can be changed and modified at will, and with results replicable and observable. By combining this with

our knowledge of the root causes of incentive motivation, we can make testable predictions.
In the chapters to follow, we will a use a discrepancy theory of motivation to explain how we misunderstand and misapply incentives to control individuals and societies, how we can use them appropriately to effect the prediction and control of behavior while meeting human needs, and how we can use incentive to control our own behavior. The terms of our theory or its data language must map to observation and to predicted and real observations when the values of the parameters of the theory change. In other words, it makes predictions for day-to-day behavior and embedded affect that are testable in experience and in fact.

And it may be wrong.

Like Einstein at his patent office position knowing how the facts of nature can easily snap in two the best laid theories, for our aspirational universal predictions for behavior from the trivial to the significant, it is best not to quit your day job!

Perverse Incentives

Negligence and Knowledge

Bring flowers to your wife two days *after* her birthday, and you should not be surprised if she promptly swats you with them and storms out. Bring a set of power tools to your wife *on* her birthday, and you should also not be surprised if she threatens to use them immediately, on you! In the former case you were negligent in knowing the timing and measure of your present, and in the later you were negligent in basic knowledge of the rudiments of female psychology. Incentives are transactional, and from etiquette to economics, we expect a thank you for every please, and something always in return for our money. But of course, it doesn't always work out that way. We are not as practiced being as insightful as a chess master with the ability to plot our opponents every likely move.

A *perverse incentive* is an explicit and definable incentive that has an unintended result that does not conform to the expectations of the one who designed it. The result may be the opposite of what we want, be less or more than what we want, or it may have no effect at all. For the micro-transactions that populate our lives, incentives work just fine. However, when we take the rudder to change the direction of our lives or the lives or others, there are other currents or incentives that if left unseen, will often leave us on the emotional rocks of frustration and failure, or even at times, confidence and success.

Incentives are easy to compose, easy to impose, and easy to ignore. It is this latter point that makes the results of incentives unpredictable, and very often, perverse. *Untended incentives* occur when an incentive is continually

applied contingent upon *one* aspect of behavior, and with little to no regard for the other aspects of behavior and the unseen or *unintended incentives* that may accompany it. For example, a teacher uses the untended incentive of a good grade for a specific performance on a test, and whether the student is engaged or bored when preparing for the test, and knows, understands, or even likes the material is irrelevant.

Untended incentives are perverse when they are contingent upon narrow *markers* of behavior rather than are flexibly arranged to follow and shape variations in behavior, and do not account or control for other extraneous incentives that may alter aspects of that behavior. For example, to reward a child for promising to be good may encourage just more promising, or the mere appearances of good behavior, which reverts to chaos when the parent's attention is elsewhere. Other incentives to misbehave, such as peer or sibling pressure, or just diversions from doing well, such as social media or television, are uncontrolled by the parent.

When incentives are narrow and untended, our achievements can become paper thin, like a Potemkin village,[73] a model community if viewed from afar, but merely cardboard cutouts when looked at closely. On the other hand, a narrow incentive of payment to write a short story, any short story, may result in a considered and thoughtful piece if the author was incented as well by the opinion of his peers or the prospect of a larger audience.

Potemkin Village

Perverse incentives occur when we have neither the time nor understanding to look closely and monitor and adjust incentive to shape the necessary nuances of successful behavior, and leave that adjustment to incentives that are outside of the agencies control. Often this doesn't matter, as a Mozart would compose a masterpiece upon receiving a commission even if nothing was expected of him but his autograph. Perverse incentives do not mean that the behaviors they reward are bad, just that they are unexpected. Perverse incentives mean you have little or no control over all the incentives that shape behavior, with a result that tends more often than not to be dysfunctional. Perverse incentives occur when we do not have the time, capability, or knowledge of primary incentives of the individual or individuals whose behavior we wish to change.

A perversive incentive does not account for *concurrent* incentives that act in cross purposes to the target behavior, as in not controlling for the incentives for a child to mis-

behave, but it may also not account for *conjunctive* incentives that are implicit in the incentive itself. For example, a law mandating that a cell phone company put in fine print its rates, terms and conditions may not stipulate that it do so clearly, with confusing results that are only fine for the company which wishes to state the facts as well as profit from their obfuscation. Indeed, a simple world becomes unnecessarily complex when practitioners in diverse fields from medicine and social sciences to law and governance meet the letter of the law, or its incentives, but hardly its spirit, as it profits them to derive complex procedures, rules, routines, and laws from simple facts and principles that could be explained and exercised much more easily, but not as profitably.[74]

Finally, Incentives can be perverse not only when they do not account for *what* we should expect, but *how* we expect. The latter is defined by the theoretical expectations we have as to how human motivation works. So incentives push and pull, clash and cohere like devils and angels on one's shoulder competing for attention, and when things go wrong, blame and guilt are the results. A dramatic picture, good enough for a sermon or an errant spouse's excuse, but quite insufficient to inform how one manages a workaday environment.

As an example, consider a typical call center. The center operator may incent his operators to perform faster by paying them for the total number of resolved calls. But resolution is in the eye of the beholder, and the operators would be incented to complete calls faster than before, and not answer or answer fully all the caller's issues both real and potential. The agency would consider the calls resolved, but the operators and callers would not, and this

would be expressed in customer dissatisfaction that could translate into lost sales.

The fact that the center operator was paying for singular (a closed call) rather than convergent aspects of performance (customer satisfaction and a closed call) reflects the fact that extrinsic motivators (money) influence not different types of motivation but different types of *performance*. The call center operator, recognizing his negligence, can thus rectify his error by rewarding call center performance that successfully closes calls while maintaining a high level of positive customer feedback.

In the case of the call center operator, he could easily fix the perverse incentives guiding his operators by recognizing the responses he neglected to reward, namely customer care. On the other hand, if his issue was not understanding how motivation worked, he would be clearly out in the cold.

To understand how this fact comes into play, now consider a typical *cold* calling center, or more to the point, several salespeople who have to cold call customers on their own to get appointments and sales. The salespeople presumably know what to say, how to say it, and have the skill to engage a client and sell. Yet they fail. As any salesperson would tell you, cold calling is a scourge to motivation, regardless of how great the rewards could be, and for those salespeople who have to call scores of clients to achieve even one sale, the predictable presence of continuous failure slows cold calling to a crawl. Generally, sales managers misattribute this behavior to just 'misbehavior', attributing sales agents' behavior to personality defects rather than defects in their incentives. Sometimes this is recognized and corrected, though without the attendant understanding of why.

One solution, derived from experience if not theory, is to simply set up a boiler room. Boiler rooms are beehives of

activity, of motivated actors who are performing with a rate and fervor that they would scarcely match if acting in isolation. Their cold calling is as predictable, dull, and relatively unproductive as before, but their motivation is higher because they are now responding not only to the insignificant variances of their primary behavior, but to the real time and significant variances in the behavior of their peers. In other words, their rote behavior becomes *competitive*. Competitive behaviors reflect contrasting variances in the similar performances *of other people* occurring in parallel to yours, and with full knowledge and similar incentives for all parties as they occur. If value is attributed to contrasting superior performance related to an attribute of behavior (e.g. frequency of calling, closed sales), the individual succeeds or 'wins'. Unlike a solitaire game, where one can rage against the machine or the luck of the draw, the machine is now replaced by humans, who provide the same uncertain incentives, only personally. Competition adds incentive, or discrepancy, to otherwise rote and predictable tasks by providing a concurrent expectancy to those tasks. These concurrent expectancies can be multiplied when momentary performance provides direct positive contrast to that of others, but also indirect positive contrast through helping others achieve the same goal. This is why team sports are so attractive for both participants and observers, since their otherwise rote tasks (running, throwing, kicking, etc.) provide positive contrast for team players, team mates, coaches, friends, and the public at large.

The behavior is always right

From these examples, we note that perverse incentives are due to our miscalculation or our misunderstanding of how incentives work, with the side effect of attributing faulty incentives to obscure causes related to the uncertain or defective nature of the individual. Miscalculating incentives is understandable, as an individual soon learns that ladies like flowers, not power tools, and that a call center operator must be rewarded for the qualitative aspects of his performance, like customer satisfaction, and not the quantitative amount, or number of calls. Misunderstanding how incentives work is a different matter, as understanding the nature of how incentives are constructed does not come as second nature to us, even with correcting experience. The fact that behavior slows down and often stalls when performance becomes predictable is too often attributed to deficits in character rather than deficits in perception. Given a proper understanding of how incentives work, behavior is always 'right', which means that the right or predicted response corresponds to the right incentive, or lack thereof. The predictability of behavior however can never be exact, and although the fine grain attributes of behavior cannot be exactly predicted, the general course of it can. Just as an individual responds in different yet similar ways to pleasure and pain, so too does the individual respond to attentive arousal and its perceived cause or the lack thereof.

Incentives and Explanation

The biology of all organisms from bacteria to men conform to natural laws that are derived from explanations that make testable predictions and are subject to criticism and change. Incentive motivation is no different. An

appreciation and understanding of the nuances of motivation come from experience, as any veteran salesman would tell you. However, the lessons of experience is inferior to an *understanding* of experience that reflects a suitable explanation of how motivation actually works, and how to apply a lesson learned to other situations that on the surface seem entirely different. This underscores the importance of the *generality* of the predictions that come from good explanations. Thus, understanding the biology of disease enables you to embrace good procedures (wearing a mask, washing one's hands) and discount bad ones (chanting incantations, making animal sacrifices) without having to run experimental trials comparing the health of those who pray hard with those who don't. So in lieu of explanation, the lesson of the boiler room remains a specialized observation, inapplicable to other situations which although similar in the abstract are ignored because they are dissimilar in appearance, and appearance is all that counts.

Perverse incentives demonstrate how the misunderstanding of why incentives work can lead us not only away from proper procedures to change behavior, but also to the misattribution of the causes of behavior to genetic, personality, or other obscure and intractable events, and to corrupt not only individual interests, but also the health and wealth of nations.

Perverse Economies

The Invisible Hand

Every individual necessarily labors to render the annual revenue of the society as great as he can ... He intends only his own security, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention ... By pursuing his own interests, he frequently promotes that of the society more effectually than when he really intends to promote it. I have never known much good done by those who affected to trade for the public good.[75]

-Adam Smith

The Scottish philosopher Adam Smith's 1776 book the 'The Wealth of Nations' was the first comprehensive account of political economy. A surprisingly readable book that was of inestimable importance for the foundling science of economics, Smith identified the self-interest of the individual with collective virtues that were embodied as a market-based system, the dedication to and disparagement of which has caused much spilling of ink and blood. Most certainly, the contents of self-interest are not a sign of timeless truth, but more likely a sign of the times. Self-interest is a perspective that changes with self-knowledge of what our true incentives or interests really are. Indeed, much of what was regarded as self-interest a hundred years ago is maligned today. Conquest, servitude, discrimination, and prejudice were part of the natural order, and complied with the self-interest of individuals and nations. Of course, why we want to obtain and possess material goods as individuals or nations is simply conformity to an idea that changes little with the times. We all agree with what we

need to do, it is *how* to do it that is the issue and changes with manners and morals. So assassinations are out, but character assassination is in. When the how is resolved to the satisfaction of all parties, so are the social disagreements that play out on familial, social, and political stages.

Draining the Swamp

A popular metaphor for social and political change is one that used to have literal meaning, and with incentives equally perverse, and similarly important lessons to be learned. As a lesson for how explanations can change the *how* of social change, we have to go back in time more than one hundred and eighty years.

In the northwest Florida coast in 1840, lots of people had a problem with gas, swamp gas that is. It was widely believed at the time that swamp gas was the cause of malaria, and that absence a cure, the best way to confront the disease was to avoid it. So, the solution, or at least in the toxic environment of the Florida marsh lands, was to merely drain the swamp. Of course, draining swamps for an area that was mainly swamps would be an expensive and difficult affair, and an alternative solution a bit less expensive was to construct hermetically sealed rooms where the air was conditioned to be gas free, and a bit cooler to boot.[76] These solutions were effective, but expensive, yet still did not eradicate malaria, and the local population remained less productive, sickly, and a lot less sociable. Another and much more affordable individual solution, doubtless inconvenient yet certainly one hundred percent effective, was for a swamp dweller to simply move to a place with no swamp gas, like Montana. The first set of solutions required government subsidies that led to

outcomes of middling effectiveness, and the second required individual initiative for a sure solution that was doubtful for a population of limited means and education. This dilemma of social versus individual responsibility for a public health issue can devolve to a judgement of who is responsible for *individual* health, the government or you. This debate would have carried over unresolved into the decades to come if the biological cause of malaria was not revealed later in the century, and all parties would agree that the effective and economical solution of spraying for mosquitos would eradicate the disease and allow a harried population to live free, and with only the humidity to be concerned about.

In the 19th century, public health solutions were confusing and ineffective because of an inadequate understanding of disease, and it would be easy to see how inadequate solutions would devolve into fractious arguments that were informed by a faulty knowledge of how the biology of organisms works. Similarly, in the 21st century, a misunderstanding of the neuro-psychological roots of incentive has evolved into arguments at least as divisive and rancorous, with the bifurcation of opinion deriving from where in the human equation does motivation sit: a controlling environment mandated by government or an independent 'self' with the freedom to decide. But as with many difficult decisions, is just depends on which way the wind blows.

Individual and Social-isms

The causes of any physical or biological event invariably determine the institutional solutions. For the case of malaria, a state run or 'socialized' solution is preferable,

where the electorate decides on a uniform course of action and appoints and funds individuals to execute it. However, if a vaccination was the solution rather than mosquito control, then it would be easy to envisage decisions to be made by individuals, who would provide the monetary incentive for pharmaceutical companies to come up with the best and most economical solution.

From the virtues of family life and honest work to the participation in the political and social institutions that serve the common wheal: life, liberty, the pursuit of happiness is the guiding coda of our contemporary civilization. However, although we are all in general agreement of what our core psychological values should be, this does not denote the specific incentives which ensure how we fulfill them.

From the conservative perspective, products, services, and ideas that serve individual tastes represent the invisible hand of the free market, so that good ideas succeed, and bad ones fail. Liberalism on the other hand means that there are inviolable collective goods that prevent the anarchic tendencies of 'every man for himself', that when ignored would devastate populations and economies. Therefore, it is the government that establishes the ground rules for incentive as reflected in common law.

The result of this dichotomy, for western economies at least, is a social compromise with mixed economies where law, education, health care, defense, policing, and the channels of commerce from roads to internet access meet universal and enforceable standards, and the goods and services that are necessary for individualistic and not common needs are determined by evolving tastes within a free marketplace. Ultimately, freedom completely unregulated is anarchy,

and when totally regulated is tyranny. The problem or tension is where to place the golden mean.

Collective or individual decisions as exercised through governmental institutions or individual choices that are the social frameworks for the creation and exercise of incentive, but this bifurcation in practice seldom is neat. These institutional frameworks themselves mediate incentives, but the success of whatever framework we use is dependent on the incentives within that framework that master the situation, which in theory are employed through separate collective or individual solutions, but in practice are very often not. For example, we all agree that local policing, firefighting, and other core services are best managed by government agencies, but they also require direct assistance from the public in reporting crimes and fires. Indeed, all public institutions require individual support to be successful in their charter. Often however, the incentives that achieve desirable outcomes are misunderstood or miscalculated, and it is here we have collective and market-based solutions that have results that are as far off the desired mark as the swamp draining and Montana moving solutions of the past for a now easily controllable disease. The debate between free market and collective (socialistic) institutions is not one between unequal solutions, but between how efficiently they employ incentives to reach their respective aims. If these incentives are misunderstood or misapplied, then any solution from any type of political economy, whether private or social, will be perverse.

Perverse Economies

The nature of a good is often conflated with how one can achieve it, and the disagreement regarding *means* is the difference between favoring liberal and conservative solutions, and it is the correct means or procedures that determines what combination of individual and collective (social) incentives should be employed. In other words, the endless debate between the virtues of the individual and the collective, of the free market and socialism, is as misdirected as criticism of the scaffolding of a building that can at turns transform a shell of girders into a grand cathedral or a mere warehouse. As we will discuss, the great social controversies of our times regarding our social and political institutions are couched in the dichotomy of the state versus the individual, when they should be understood from the more elementary point of view of the incentives that encompass and require both.

Education

The fundamental problem is that the gap in educational achievement, which is a key in our technological economy, is due to the fact that the families of the poor who are not very educated are not talking to their children, interacting with their children, insisting they do their homework and so on. Should we say it's a failure? Let's say it's a grave error of omission. **-** *Jerome Kagan*

Maximizing the value of education means incentivizing the assimilation of knowledge for children and young adults to educating the general public through media both social and print. Here we have multiple incentives in play from different agencies (teachers, caregivers, parents) and actors (businesspeople, school age children). We also have multiple points of misunderstanding and failure. Education from elementary to graduate level is only the beginning of

a never-ending journey of learning, as one uses continuing education to increase job skills and to improve critical thinking and social abilities necessary for the business of life.

Formally, *the guiding principle of modern education is to incentivize children to acquire and use knowledge through their awareness of the future value of that knowledge.* Unfortunately, without the ability to presently utilize that knowledge reserved to the far future, it is an invitation to indifference and lassitude. It is easy to understand why. Learning chemistry may get you a good job a few years from now, or more likely not, but it certainly doesn't do you much good in the present. Compare that to the ability to run with, throw, dunk, and hit balls, which can get you a good job years from now or most likely not. But in the meantime, you have adoring fans, colleagues, and friends who keep evergreen your incentive to keep practicing. The reason is that doing various things with your balls gains the concurrent regard of family, friends, and an adoring public, who just happen to be sitting in the stands as you are 'playing ball'.

The influence of concurrent incentives is not to be minimized, and is a biographic aspect of most successful people, whose mentors, coaches, and above all attentive and demanding parents are the significant others that make learning significant, and not of passing and slight interest. As a rule, incentivizing is best if it is broad in its sources, diverse in its means, and continuous in its appearance. By serving multiple masters and complementary aims, accomplishment can make a mark for the ages and serve all ages. For education, this means family and friends are involved, in addition to arbiters of favor and privilege such as teachers, supervisors and the privileged elite.

This provides us with an amended educational principle: *The guiding principle of education is to incentivize children to acquire and use knowledge, through accentuating the* ***present*** *value of that knowledge.* So how can a knowledge of say, the mathematical calculus be of value to one in the present? For the same reason that a cold caller in a boiler room maintains his fevered pitch of a monotonous pitch despite continuous frustration and delay in his quest for a future goal, namely the present contrasting reaction and regard of the other people in the room. Even the regard or disapproval of one person can be the critical factor for a child's educational attainment. Indeed, the constant incentive of a parent who demands excellence in intellectual accomplishment can be all the difference between a child being a wastrel or a success. Overall, a child's effort to learn is not due to the prospect of exalted rewards that are years away in a netherworld of a good job and plush retirement, but rather to impress and influence his or her peers, parents, teachers, mentors, and friends in the moment, and from day to day. Incentivized value for the student as actor comes from many agencies, from parents and friends to coaches, mentors, fellow students, and social media. If these agencies are winnowed down to a few, such as teachers, then teachers cannot teach because they cannot, as isolated agencies, effectively motivate. This is particularly the case when children are motivated at cross purposes to being educated, as when skipping or disrupting class is incented by a student's peers or other distractions.[77]

Naturally, curricula must be designed to encourage and sate curiosity and critical thinking, as one can be more inclined to explore virtual worlds if there are lots of twists and turns along the way and problems sets that must be resolved. But appealing to the intrinsic interest of curiosity

or exploration is not enough. Indeed, incentive is made of plainer stuff, and the pressure of competition or contrast between individuals, groups, and the changing regard of significant others can make the simple task of hitting a ball with a stick, or mastering the more complicated skill of the mathematical calculus, equally worthy of accomplishment and regard.

Unfortunately, for educational systems, incentives are perennially misunderstood, not just in terms of how knowledge should be imparted, but how it should be used. This is reflected by the incorrect assumption that knowledge automatically translates into wisdom. For example, the narrow marker for children to simply memorize facts by rote presumably also serves the role of fostering wisdom or problem-solving skills, but perversely produces little of either. In other words, the incentives to learn are different from the incentives to use knowledge in creative ways, or think. *Knowledge* is the accumulation of facts, but *wisdom* is the critical ordering of the relationships between facts, and is exemplified by the critical thinking that is necessary to solve problems from the simple (like unplugging a drain) to the complex (explaining the universe). In addition, critical thinking is a necessary skill that prevents an individual from following the direction of the crowd, the demagogue, or the seductive patterns and prejudices in life that eschew explanation and lead to the unthinking justification for assorted tyrannies. This requires an incentive to think critically that is different and more difficult than rewarding merely rote learning and the rote obedience that it requires. In other words, it is difficult enough to motivate children when they are encouraged to be as disputative to instruction as Socrates. But yet, it is necessary, for if a child is not encouraged to question

everything, he will question nothing, with outcomes far more dangerous and perverse.

The perversities of education ripple down to how education is applied, and here we find a politics that is just as perverted. Although we can segregate misinformed actors from those informed specialists who can handle our legal disputes, medical problems, and plumbing, political decisions are far more democratic, and reflect most plainly the limitations of education. An unengaged populace is the result of an unengaged education, and produces an electorate easy to persuade through simplistic solutions, misinformation, and demagoguery. Even with intelligence inherited or acquired, one can still be educated but with an uncritical mind remain ignorant. After all, it was an enlightened Athenian electorate that inspired as well as murdered Socrates.

Prejudice

The universal truth about our tastes is that they are universally different. Our prejudices are the bane and the spice of life, and account for the diversity of material goods that populate our marketplaces, and shape our social preferences based on the personal attributes of individuals, peoples, and races. We prefer the company of people who have physical attributes based on age, sex, personal appearance and the mental attributes as displayed by personal conduct, intelligence, and education. However, prejudices or pre-judgments are misjudgments when behavior is attributed to race, ethnicity, or culture, when it is incentives that are at fault. In other words, given a fair shake and the proper encouragement, everyone will aspire to and attain the universal virtues of leading to mutual comity and ambition, thus making it difficult for others to

attribute dysfunctions in behavior to genetic, racial, or other immutable causes. Therefore, the solution for prejudice is to fix the incentives that make attainment unequal, and thus mitigate the reason to *be* prejudiced. Unfortunately, the commonly proffered solutions are easy, but perverse, as incentives are mismatched to behavior, or matched to one aspect or marker of behavior, leaving the rest to the vagaries of the environment.

For example, affirmative action programs match students to college programs that provide a superior education and successful career paths, but do not consider that curricula may overmatch the capability of students to successfully complete them. This is a recipe for ineffectiveness and disaster, as students are thus primed not to succeed, but fail.

Similarly, with *virtue signaling* we reward the signal, and not the virtue, which takes attention and diligence that is unrewarded by a public with a short attention span. Thus, by tearing down a statue, voicing an ardent stance on social media, or otherwise passively protesting, your position is noted in the moment, to be forgotten until the next social outrage that merits your briefest of involvement. Virtue signaling is a half-step towards a goal with the inference that the person will follow through with their support one time or another, which they likely won't.

Ultimately, to change prejudices, incentive structures must be changed for those whose behaviors are disparaged, not of those who *do* disparage. So if minority neighborhoods are neat, crime free, and are havens of industry and the arts, then it is much more difficult for prejudices to take root. The problem is that banning the expression of prejudicial views suppresses it, not eliminates it, as the perceptions that drive prejudices remain unchanged.

Altering incentive structures does not require investing in new physical structures or through the transfer of wealth. It requires instead a change in the context rather than the content of rewards, or in how they are arranged rather than what they are. Prejudice is an issue when we attribute poor behavior to immutable characteristics rather than mutable incentives, but ironically and as we shall see, *good* behavior incites a prejudice all its own that is best remedied by secrecy.

Rich and Poor

In 1955, to be well off was to have a small frame house with one car, one breadwinner, a couple of kids, modest home cooked meals, three television channels, a few good books, and an annual vacation to the nearby beach. Everyone was happy, but those good feelings would be fleeting if you, your family, and your modest belongings were transported to the 21st century, where your middle-class existence would put you square into the lower classes. Your life style would not have changed but the contrast to the life style of others would be extreme, and your happy existence would be reduced to *relative* poverty and want, at least in terms of all those things that others possess that you now want.

In economics, *absolute* gains are the coin of incentive, and are denominated in the utilities of living, from control over our social and physical environment to the materials goods we use. However, as we have demonstrated earlier, motivation is determined by *relative* and not absolute information about our place in the world. This information is volatile, and moves with the changing winds of information and perspective. By ignoring the relativity of incentive, prevalent economic thought misunderstands progress, which is as relativistic as time itself.

An affective but not rational marker for the good is the positive or negative contrast that occurs through social and economic comparison. Positive contrast can be implicit, as when an individual feels proud, competent, or richer than other people, and can be explicit when he lets others know about it, causing a negative contrast in the latter's own perspective that is felt as the affective state or envy or jealousy. Negative contrast is acceptable when it is the price paid for expertise, as we defer to the greater wisdom of doctors, lawyers, and electricians, and it is also acceptable, at least for a short while, when we lose out in the competitive games of life, from sports teams we watch to the competition at work for salary, title, and social standing. When negative contrast overstays its welcome, then we complain and forswear the resultant inequalities. Indeed, to lose the big game is one thing, but to be forever trolled about it is quite another!

We are not troubled by negative contrast if it is immediately consequential to behavior that up to the end had some likelihood of positive import, but are bothered by conspicuous negative contrast that serves no general interest. The solution for this is a bit of modesty personally or institutionally imposed. Individual braggadocio merits its own swift response within close personal circles, but in the social arena can be the source of discontent, and at times, revolutions.

Equality is impossible, as everyone will be different in terms of likeability, attractiveness, capability, or wealth. Moreover, altering the differences to favor yourself is motivating in the spheres of personal and professional competitions that animate our lives. Because inequality is a double-edged sword, with winners and losers, the solution is to keep inequality an asymmetrical and private affair,

with the winner reveling in his superiority, and the loser forgetful of his inferiority. In this regard, making just the appearances of equality are easier and more achievable than the actual leveling of status and wealth through governmental or social fiat.

Corporations eliminate negative contrast by making pay scales and perks a matter of individual confidence and privacy, and egalitarian societies are known for their promotion of individual modesty. Still, this is easier said than done. Individuals reduce negative contrast by providing a commons for worship, education, and a impartially administered law. However, these egalitarian conventions are often tested. Indeed, the millionaire living in a modest house down the block is of no concern to others, but if he moves to a secluded and gated mansion, sends his children to exclusive private schools, and bends the law through patronage, others would take notice, be envious, and in the worst-case, rebel.

The contrast between the millionaire and his less economically endowed neighbors would be mere jealousy if they were self-sufficient, but less so if they barely sufficed to live. The resulting issue of 'income inequality' can be at turns a call for government action (socialized services) or inaction (a free market) to assure and encourage the achievement of minimal private incomes that provide equal health, security, and opportunity, or it can be a call to secure *psychological* wellbeing that require a leveling of *all* incomes, so that negative contrast caused by the uses of income, such as when differences in material, social, and political status are eliminated. The first is relatively easy, as basic human needs can be met at a low and basic cost, but the second is not robbing the rich to give to the poor, but rather to the *relatively* poor.

Presently, we can have the material lifestyle of Louis XIV, with luxuries unimagined in his time as well as a good dental plan, yet equality remains a sirens call, and like Louis, enough is never enough if your neighbor has more than enough. Ultimately, egalitarian societies are created by eliminating the differences between individuals or just hiding them. The former can be a matter forcible reallocation, whereas the latter is a matter of judgement on how one should live their lives. Indeed, keeping up with the Jones' would scarcely impact our happiness if the Jones' had kept their material possessions private. Thus the cure for income equality is not income redistribution, but better zoning laws that reduce or keep ostentations out of sight, and thus out of mind.

Income Inequality

The distinction between rich and poor is not just a matter of perceived contrast, but demonstrable need. And the often-dire needs of others are relatively easy to meet. About 1% of the population has 99% of the world's assets, or so the argument goes. So it is a simple matter of redistributing wealth, with everyone's needs can be met without the slightest encumbrance to the wealthy. However, provisioning assets to meet someone's need is not the same as provisioning the *incentive* for that person to meet that need. Or in other words, to give a person a fish does not teach him to fish, or necessarily give him the opportunity *to* fish or even market his fish. These are all dependent upon incentive systems that are independent of the charity of others, and are built into the social, economic, and political institutions that govern the motivations of peoples and the wealth of nations.

In the past, European empires provisioned rudimentary incentive systems (English common law, religious conversion) that were imposed through conquest. Now if a foreign expeditionary force took over some impoverished state and imposed the social democracy of say, the prosperous state of Singapore, this would be the height of rudeness, racism, and injustice. Indeed, intervention in the legal, religious, social, and familial institutions of other countries and cultures is nowadays not worth the trouble for intervention, but worth merely the palliative of charity. But this changes nothing, as no one proverbially learns how to fish (or for that matter raise and educate a family or have a democratic politic), with the result that social problems fester and worsen, and in the increasing debilitation and impoverishment of the race.

Ultimately, the issue is not income inequality, but *incentive* inequality, with the former having current intellectual precedence due to the false assumption that individual volition is unmoored to incentives both subtle and real, but would follow some golden mean if one merely had the resources but not the guidance, while ignoring the fact that it is the guidance of incentives that provides *for* resources, or a world of abundant fish.

Scholarship

"When I read academic literature, all too often by paragraph three I'm lost in a morass of quantitative analysis that is far beyond not only my abilities but those of almost every businessperson I've ever met. In my view, the authors devote far too much of their time conducting research and writing about it in articles that only their peers understand and spend too little time actually teaching. As a result, their students are getting progressively less for their money, a guarantee of future serious trouble for higher

education." Larry Zicklin, Professor at New York University's Stern School of Business."

"Social scientists by and large spurn the idea of the hierarchical ordering of knowledge that unites and drives the natural sciences. Split into independent cadres, they stress precision in their words within their specialty but seldom speak the same technical language from one specialty to the next."[78] E.O. Wilson

The first human act of scholarship occurred when a proverbial caveman saw a fuzzy outline in the distance and resolved the picture by resolving to move closer and see what was actually there. The entire agenda of human curiosity and discovery reflects this need for an ever-increasing ability to improve our focus and see what is there. What *is* there can be the endless vista from the vantage of a mountain peak or merely the view of an ant carrying a bit of a leaf. With our current instrumentalities, we can now put into focus vistas from the cosmological to the quantum, from the infinitely large to the infinitely small and to a degree, makes sense of it.

The hard sciences such as biology and physics are not 'that' hard if one notes how observation can reveal truths that can correct, verify, or topple the best theories of how the world works. Theories predict the world and observation corrects for it, and the best explanations are always subject to criticism and modification from experiment and from the technologies that can literally ride on experiment, and are therefore refreshingly singular. Thus if Newton's equations don't work in experiment, or for that experimental rocket ship that is guided by those equations, then Newton's theory would crash along with the rocket.

For the social sciences however, the situation is starkly different. Unfortunately, human beings are not cannon balls or shooting stars, and the gravity of a personal situation that

get you down is not quite the same as the actual gravity that pulls you down. Throwing a ball from a to b is easy to calculate using simple physical laws, however the motivation that gets you to throw that ball in the first place is well-nigh intractable. There are just too many variables to account for to predict what any individual would do if simply given a ball. So if you cannot predict specifically, you predict *statistically*. Unfortunately, statistics only measure correlations, and do not provide explanations. Thus the social sciences have devolved to endless comparisons between groups, individuals, and individual cases, with the nature of incentives wholly inferred rather than real. In other words, because motivation is so complex it is therefore permanently obscure, and at most can only be resolved not by deduction, but by inductive procedures that look to correlations rather than causes. By comparing one group to one group, or a *between group design*, rather than looking at individual changes within individual subjects, or a *within group design*, the nature of things becomes fuzzy, with a resulting social scientific perspective that is all syntax, or word play, with little semantics, or rooting words to actual behavioral or neurological events. By holding to the standard of a similar and often provincial syntax (unified language) rather than similar semantics (unified meaning), the social sciences lose their moorings, and becomes less science than literature.

And of course that is what the social sciences have become, with an ever-expanding tonnage of research, and circular islands of reciprocal incentive, or schools of thought, that incentivize adherence to narrow languages and narrower subject matters. The incentive is not to produce knowledge that is of value to people, or even a subset of people, but to meet abstract bars of accomplishment that signify expertise

for academics *to* academics, and this means tenure. Indeed, the social sciences produce a corpus of research that resembles more an intellectual corpse, a foundling that is dead on arrival and to be buried at once without even a cursory glance. The statistics tell the tale, as about 82 percent of articles published in the humanities are not even cited once. Of those articles that are cited, only 20 percent have actually been read, with ten being the average number of readers for published article. In fact, more than half of academic papers are never read by anyone other than their authors, peer reviewers, and journal editors.[79]

Although the social sciences are reduced to stunning irrelevance by the perverse incentive of publish or perish, the hard sciences are scarcely immune to this fever of logorrhea. *Philip Anderson, a winner of the Nobel Prize for Physics opines that "in the early part of the postwar [post-WWII] period [a scientist's] career was science-driven, motivated mostly by absorption with the great enterprise of discovery, and by genuine curiosity as to how nature operates. By the last decade of the century far too many, especially of the young people, were seeing science as a competitive interpersonal game, in which the winner was not the one who was objectively right as [to] the nature of scientific reality, but the one who was successful at getting grants, publishing in Physical Review Letters, and being noticed in the news pages of Nature, Science, or Physics Today.... [A] general deterioration in quality, which came primarily from excessive specialization and careerist sociology, meant quite literally that more was worse."*[80]

Ultimately, to reverse the ossification of knowledge is to repurpose incentives to reward the *usefulness* of knowledge, and that means the end user. This can be done through corporate intermediaries who fund basic research for the

intent of using it to develop new technologies, or through the primary recipient, the paying audience itself.
If the basic science was not directly or indirectly required for the basic technologies we used today, Newton's mechanics would have been as well regarded and remembered as his treatises on alchemy, which useless to practical chemistry, were never worth their weight even in fool's gold. Ultimately, the corrective incentive for perverse scholarship are the practical uses of scholarship. This emulated an Italian renaissance tradition of an intellectual marketplace where students and not fellow teachers selecting the best teachers, with the marketplace determining the value of scholarship, and changing the incentives from those who produce knowledge to those who consume it. In industry and commerce, this means those ordinary folks who consume knowledge in the knowledge-based products and services they consume, from software to softballs.

That's Entertainment

For scholarship, the closed circles of mutual regard can be incestuous, and result in hobbled creations that appeal to only their parents, and certainly not to the public at large. Entertainment is the same, with people in the highest ranks of society creating one edifice after another, from opera houses and stadiums to great museums and libraries as tokens of their societies' accomplishment, power, and good taste. From the elites of antiquity to the present day, getting the knack of artistry was literally putting things up, immortalized in stone monuments and statuary and the wallpaper of paintings and tapestries hanging from the rafters. From cathedrals to colosseums, and from the literature and music of long dead artists, our culture is

denominated by these headstones of culture, and we pass by them with reverence and with understanding made with a glance, and wear them as virtual epaulets to mark our collective achievement and status.

The defects of memory are a perverse reminder when we forget to see what purpose in the past artistry actually served. In classical times it was an expression of the authority or divinity of emperors and kings, in medieval times it was an expression of faith, and modernity makes them a mark of corporate or institutional power. However, for the lesser social classes who could not make their mark in stone, canvas or print, it was in simple entertainments that are now lost to history.

Although our entertainments may aspire to posterity, they rarely attain it and are more attuned by the audience at the moment. Indeed, in Mozart's and Shakespeare's time, art, music, and literature did not exist to produce petrified works of timeless art that were as rarefied as their audience, with characters so exalted and perfect that they would 'shit marble'. Rather, timeless perfection was subordinate to the imperfections of entertainment. But entertainment can serve many masters, and 'perfect' entertainments had to serve them all, though this prerequisite is forgotten when Shakespeare and Mozart are performed in austere theaters and concert halls far from a maddening, diverse, and raucous crowd that served and inspired the playwright and composer in their time so well. What made a Shakespeare and Mozart be were less due to imperial dictates and more to do with serving popular tastes. But what makes the for incentive for something tasteful, or elevate the banal to the sublime?

The inherent charms of knowledge passes from simplicity to complexity as a child passes to maturity, so that

individual interest advances from a game of tic tac toe moves to checkers and then chess. For this progression, education is key, and to elevate the arts as one must elevate reading and writing, our entertainments must be taught. Practicing the piano or guitar, cooking food, mastering chess, or learning any art or craft not only elevates the knowledge of the crowd but elevates the demands of the crowd for offerings that *surpass* their knowledge.

The level of engagement in our entertainments spur greater demands in their complexity. If you play chess sparingly, observing a middling player can entertain, but if you play the game often, only the play of a grandmaster merits attention. Similarly, a jazz pianist will be a more discerning patron of his art than the mere occasional listener, as well as the practitioner or any craft or any art, from woodworking to cooking to novel writing. Ultimately, the level of sophistication in the arts is not in merely enjoying the past, but in reimagining that past in the present. It can be from endless reinterpretation of a Shakespearean play or Mozart symphony, or from the creation of new plays, poems, and works of art and music that are enjoyed and demanded from a discerning and *participating* audience.

We honor and relive the best moments of our dead ancestors as well as their creations, but art is a living thing, and to grow in appreciation as well novelty, it must involve and be mastered by its audience. Consider if only the arts were taught in schools, with reading and writing to be picked up at our leisure. Then we could compose arias at will, but our writing would scarcely surpass a child's with novelistic pleasures culminating not in Tolstoy but Dr. Seuss. The perverse inventive for our schools is that they teach us the skills for survival, but not for the edifying and social value of entertainment, with the result that our

diversions are impoverished because we do not know how to construct them. Engagement in entertainments require expansion of the mandate of education to know how to entertain and to demonstrate to students how the endless unfolding ways the arts can tell us new things about ourselves and in the revealed beauty of creation. Indeed, this economy of neglect is perhaps the most perverse of them all, and as we shall see, the most easily corrected.

Pervasive Incentives

"In Italy, for thirty years under the Borgias, they had warfare, terror, murder and bloodshed, but they produced Michelangelo, Leonardo da Vinci and the Renaissance. In Switzerland, they had brotherly love and five hundred years of democracy and peace – and what did that produce? The cuckoo clock."

Orson Welles in the movie 'The Third Man'

The Rare Shakespeare Hypothesis

Warfare, terror, murder, and bloodshed are hallmarks of chaos, and although chaos can be a mother of inspiration, it certainly is a purveyor of uncertainty. Generally, that uncertainty is of the most unpleasant and devastating sort, but when nations and people compete, bloodlust can be turned to other more civilized ways to assume control. Settled societies, and settled knowledge, brook no doubters without a doubt, as there are few rebel voices in a cloister. But with chaos, rules are abandoned, but at least you are free to think before anarchy swallows you whole and leads to a dark age where everyone is out for themselves. Whereas incentive is dampened in societies under the iron boot of universal conformity, disorder can rearrange incentives for brief moments in time and locale with creations that can blind succeeding generations in wonder. Within a sea of chaos there are islands of incentive where talent can take refuge, and when a seed falls on exactly the right plot, thrives. In Renaissance Italy, Michelangelo had the advantage of a mentor and a nearby quarry that provided the marble for honing his art that was guided by the patronage of the Florentine ruling class in creating his

masterpieces from the Pieta to his David. Similarly, Mozart had a musician father who trained and encouraged him and introduced him to the ecclesiastic and royal nobility that commissioned works from operas to dances to masses. Would a Michelangelo or Mozart have developed if the environmental stars had diverged even slightly? From history, the answer comes from the fallow inspiration of entire societies, from imperial Rome and dynastic China, that when compared to the torrent of creativity of classical Greece and renaissance Italy with a fraction of the population and in but a sliver of time, created nothing. This informs one of the immense potential of the human spirit that remains untapped when incentives are misaligned or non-existent.

Life is as exceptional as it is rare, and rose from one planet in a chaotic sea of endless worlds, where all combinations were tried, and all failed except for one infinitesimal exception, on one planet, and on one tiny spot. The 'rare earth hypothesis' presumes that the circumstances that provided the foundation for the evolution of life were exceptionally rare given the highly randomized nature of the individual conditions necessary for life to occur. But rarities can become recipes once we know the formula, and although we don't know the formula yet for life, we do know how to make life lively.

Like the birth of life on earth, cultural rebirths or Renaissances are equally unplanned and are exceptionally rare, however their recipe is not. We know what is necessary to nurture life, and genius, like life has nurturing environments of its own. For all the Renaissances of the past, the social and physical environments that nurtured them are sobering. Without sanitation, literacy, a stable politic, or even a good dental plan, genius had to blossom

from the dunghill of not even third world, but failing states. That it did is not a tribute to a human will to surmount adversity, but something much simpler, namely the subtle bonds of incentive.

Behavior is like a dance, full of twists and turns that are shaped by multiple concurrent incentives signaled by the changing rhythm of the environment, and although we see myriad conflicting motives in our behavior, for others we see few, or more practically, only notice the one's that we impose. Naturally, we are often not surprised when behavior takes a sharp turn other than what we predicted, but at the very rare times the sharp turn is noticeable and aims true, then we have to take a closer look at the landscape of incentives that insured our luck, though that is not as easy as it may seem.

A Dull Landscape

The societal values, living standards, and politics of England in Shakespeare's time would have the object of scandal in our present day, yet it was this insular island world that was to become the intellectual and imperial standard bearer of its day and for centuries to come. But to understand England, we must understand its beating heart, the city of London. The population of London in 1600 was 200,000 souls, less than that of the metro area of Biloxi, Mississippi. By the end of the sixteenth century, only one third of the male population could read, and the proportion of literate women was much less, perhaps as low as one in ten.[81] And of course, there was the recurring plague, with a mortality rate of fifteen percent and more, and no cure on any horizon. For the educational institutions

which provided the intellectual heartbeat of the nation, its prospects were surprisingly harsh and regressive.

"Grammar schools were all over the country at that time and were attended by boys of similar backgrounds to Shakespeare's. There was a national curriculum set out by the monarchy. Girls were not permitted to attend school, so we will never know the potential of Shakespeare's sister Anne, for example. She would have stayed home and helped Mary, his mother, with the household chores.

Physical Education was not on the curriculum at all. Shakespeare would have been expected to learn long passages of Latin prose and poetry. Latin was the language used in most respected professions including the law, medicine and in the clergy. Latin was, therefore, the mainstay of the curriculum. Students would have been versed in grammar, rhetoric, logic, astronomy, and arithmetic. Music was also part of the curriculum. Students would have been regularly tested and physical punishments would have been given out to those who did not do well.

The school day was long and monotonous. Children attended school from Monday until Saturday from 6 or 7 o'clock in the morning until 5 or 6 o'clock at night with a two-hour break for dinner. On his day off, Shakespeare would have been expected to attend church. It being a Sunday, there was very little free time, as the church service would go on for hours at a time! Holidays only took place on religious days, but these would not exceed one day."

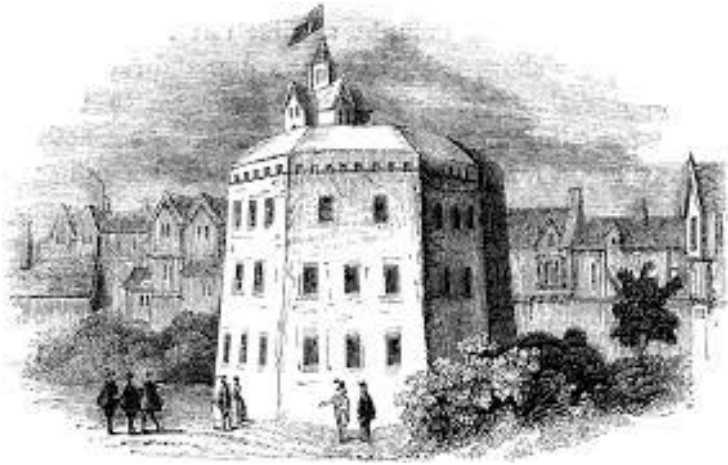
"At the end of the term, the school would put on classical plays in which the boys would perform. It is entirely possible that this is where Shakespeare honed his acting skills and knowledge of plays and classical stories. Many of his plays and poems are based on classical texts, including "Troilus and Cressida" and "The Rape of Lucrece."[82]

In many ways the scholastic preparation for Shakespeare was worse than any contemporary primary school

education, limited and rote, and relative to our times, antiquated. At least for extracurricular activities, the play, at least at the end of the school year, was the thing, and for Shakespeare, it soon became the only thing. So with the itch to act and to write, all that was needed for inspiration was the kindling of incentive, and a cauldron where it could ignite.

The Cauldron of Incentive

In 1577, the Globe Theater was constructed. At that time, William Shakespeare was 12 years old. Like the invention of the internet and many other revolutions in media and communications, the Globe, and its sister theater the Rose, were the linchpin of Shakespeare's motivation, and it could be argued the Elizabethan Renaissance.



The Globe Theater during Shakespeare's time

Before 1577, plays were private affairs attended in private homes, but with the construction of playhouses, an audience bored and bereft of entertainment provided the

demand for a new type of storytelling acted out on a wooden stage. And with the demand came the supply from dozens of newly self-appointed playwrights who were as copious in their output as any contemporary streaming service, and with the same level of generally poor to middling quality.[83] As a historian recounts **"***In two weeks during the 1596 season a Londoner could have seen eleven performances of ten different plays at one playhouse, and on no day would he have had to see a repeat performance of the day before…Playwriting had quickly become a growth industry and a profession. Of the twelve hundred plays offered in London theaters in the half century after 1590, some nine hundred were the work of about fifty professional playwrights."*[84]

The Globe theater was the nexus of this accomplishment and provided incentives that sealed a playwright's success or failure with judgment as final and brutal as before any Roman mob in the coliseum. It was into this cauldron of incentive that Shakespeare's plays were born. That his plays succeeded was not testament to any highbrow or esoteric greatness but to meeting the diverse needs of the audience in unsurpassed prose.

It was the universality of his plays appeal that was key to his success. Rich or poor, young or old, literate or illiterate, all found a voice in Shakespeare's plays. But these were not chance elements, but reflective of incentives that pervaded every aspect of the bard's social life.

Formally defined, pervasive incentives are concurrent unmanaged incentives that converge to one desired outcome that meets all demands. Pervasive incentives represent multiple *parameters* of behavior that must be met and rewarded separately. Shakespeare's creativity was tested because he had to simultaneously meet multiple disparate standards for approval with results that

withstand the test of time and meet his own personal criteria for excellence. If the cinematic rendition of this environment in the film 'Shakespeare in Love' was true it would incorporate incentives like these:

Make the play cheap to produce and ***satisfy your financial backers***

Include sex and violence and ***gain the favor of the audience***

Have good roles for your actors and ***gain the praise of your cast and director.***

Include roles for gravediggers and kings to ***satisfy those in the expensive and the cheap seats.***

Have pratfalls and jokes and ***gain the favor of the queen.***

Have romance and odes to love and ***seduce your paramour***

Write lots of plays to ***pay the bills***

Speak to every age and ask every question from embodied characters, to ***satisfy a personal need to know, and to see what dreams can be made of***

Because of the rich feedback environment provide by the social networks of Elizabethan England, Shakespeare was motivated to not only create but to hone his creation to literary perfection to match the variants in demand that satisfied all of them, except ironically for the incentive of the prospect of posterity, a notion that he apparently cared little about, with his plays being posthumously published only

through the care of two of his colleagues. In any case, the feedback worked, but it was an entire ecosystem of incentives provided by an engaged population that made Shakespeare be. Shakespeare not only had to meet a diversity of demand, but a rising level of complexity from many sources of demands. Thus a pun had not only to be interesting to the ill-educated peasant in the rafters, but novel also to a jaded royal ear who had heard it all before.

The lesson of Shakespeare and the Elizabethan Renaissance is that behavior, even that of genius, is not only incentivized, it is *shaped*. The incentives in Shakespeare's time were remarkably democratized, with everyone from beggars to aristocrats having a hand in the resulting inspiration. The poet's inspiration came from a peasant's shouts in the rafters to a lady's favor to a monarch's nod. All had their role and mirror in Shakespeare's characters, with everyone from gravediggers to Kings having their part vaunted in prose. Above all, the incentives that made Shakespeare were remarkably simple, yet prolific, but it was their pervasive influence at different times and places that made the difference between a supreme poet or a failed one.

The obsession that leads to true inspiration is not led by a singular incentive but is coddled by them. They must be everywhere, all shaping behavior to a degree right or left, but all pointing north. So the play was not only the thing but also satisfied diverse incentives that were native to the immediate and local culture. Simple enough, but given the democratized, technological and far more literate society of today, the question is, where are our present-day Shakespeares? The answer is that they are still a rarity, as even on earth, perfection can make for a living, but it cannot make for a life truly lived.

Ecosystems of Incentive

As Darwin noted on his epochal voyage of scientific discovery, a finch on an island in Galapagos exquisitely fits its environment, but the finch did not decide its nature and form, the environment did. Natural selection over many generations selected for those physical attributes and behavioral traits that matched the ever-shifting demands of its environment and thus provided for its survival.

But if a kindly God took note of the finch's struggles and just maintained it in a stasis of nourishment, the finch would never change and never evolve, and would likely be boring not to itself but likely to its maker. A perfect accommodation to an eco-system may make for the health of the species, but that of the individual would be different matter. Predators, periodic droughts, disease, or the chance unavailability of a mate all can make the life of a bird miserable and brief. Similarly, humans are uniquely fitted to master our environment, our populous existence across every continent attests to that. However, like the individual finch, the physical and psychological eco-system of the wilderness is not finely tuned to serve the needs of the individual, and simple variances can cause misery and often the demise of many individuals, with the species remaining unchanged in aptitude or nature. So for early humans to survive, complex and uncertain ecosystems are replaced with singular economies, belief systems, and politics from god Kings to tyrants that both enhanced and stifled human initiative and the incentives that drove it.

Monoculture

For our distant ancestors, motivation was dictated by the necessity of survival, and as civilization dawned their field of dreams came to be one monotonous field. For them, diverse ecosystems supported hunting and gathering, but could not sustain large numbers of people. The rise of monoculture or the cultivation or husbandry of individual species of plants and animals assured the growth and stability of populations, and the rise of the socio-economic structures and physical structures that were orderly also through the imposition of monocultural belief systems, from a uniform currency to the universal currency of myth embodied in the tales of men and the dictums of gods. Modernization has made these trends toward economic and cultural monoculture even more pronounced, as everything from our strawberries to our entertainments are outsourced to far away fields, creating classes of consumers, not producers. Consumption is as easy as eating and watching TV, and is a sloths paradise, but production requires incentive, creativity, and imagination, the veritable stuff dreams are made of.

Unlike in Shakespeare's day with communication limited to a horse's pace, genius today is decidedly *not* locally sourced, as audiences receive their entertainments, like their sausages, not from the local farmer but from the factory farm. There is no need for an ecosystem to demand, provide and evolve its denizens in prolific and interdependent diversity, and would be no more likely to produce a Shakespeare than a bird of paradise evolving from the successive offspring of a sparrow in a cage. Like God's captive finch, our cultural nourishment is imported from miles away, and broader incentives are measured out only to elites who listen to them from the chatter of mouse clicks

and 'likes' and are sustained by their collective patronage from subscriptions to movie tickets to streaming fees. As these islands of incentive narrow inexorably, along with it wanes the individual genius of the human race.

Perhaps Shakespeare's greatest unheralded lesson is that genius can only be for the ages and can be aspired to by all ages when it is first created for the *locals*. Indeed, the Elizabethan Renaissance populated by the poets, dramatists, and musicians of the day was not an English but a London centered culture, with no mind for the provinces or for any other part of the world for that matter. Indeed, genius is private, familial, and rooted in local culture and local neighborhoods. Like the countless undiscovered species that bound from acre to acre in the tropical rain forest, the genius of creation is local, hidden, with its beauties buried as deeply as diamonds in the earth. And if not given the inspiration and confirmation from a private audience, the aspirations of a John Donne, Christopher Marlowe, Ben Johnson and other luminaires of the age would have been snuffed out like errant fireflies, as far away agencies would have turned a blind eye to their genius, as they invariably do to the countless importunities of authors, musicians, and artists who are locally unchallenged but by the broader horizons are blindly inspired.[85]

Sadly, we continue to marvel at the brief flashes of inspiration and creativity that occur during the long and broad tapestry of human history, and bestow on them the honorifics of renaissances and golden ages, as difficult to replicate as lightening in a bottle. But admitting befuddlement about how incentives work, and seconding that notion by a fractious and incoherent social science, we fail to grasp the immense opportunity loss to the human

race, whose individuals are much more than the sum of their parts.

The historical environments that fostered the brightest lights in science and culture made life for nearly all their human subjects, regardless of status or accomplishment, nasty, brutish, and short. A full belly is not the prerequisite for accomplishment, whether it be in a finch or a human. Motivation requires something else, and furthermore, it does not have to be complicated. We need to know how it is shaped in its preferred directions and in its perversities, and although we cannot divine its exact course, we can take the measure of its general one, as even a Globe theater rebuilt in countless cities can incubate genius again, if given the right crowd.

Self-Control

If our doe had more than half a brain, what would it want in its literal field of dreams? It could plant a lotus tree, where it would graze on its leaves and live in a stasis of pleasure and forgetfulness for the remainder of its days,[86] or it could just design a better and more inviting field. In the first example, positive affect is an artifact of a drug, and in the second it is an of a dynamic engagement with the world. For ourselves we wish to pair arousal with our delights, and pleasure is often incumbent with the thrill of the pursuit. We populate our desires with accomplishments, not motives, yet it is motivation that counts, accomplishments are but waypoints.

When we think of self-control, we think of the psychological nudges, mind hacks, or inspiring aphorisms that can give wings to our own free will and keep us on the straight and narrow to attain our objective goals. A true method for self-control is like an alchemist's dream, and it is the elusive elixir that can transmute lassitude into action. Self-help advice is the ticket for seers, charlatans, or just the simply naïve. It is the perennial best seller, motivational screed, or inspirational faith. It is elusive, and it is as we presently conceive it impossible. To self-initiate without incentive is the issue of 'free will', or of a causeless cause. Short of a beating heart and the involuntary traits that keep us alive, the idea that humankind can act independently of incentive means that it need not be guided by incentive, a recipe for in-determinacy that is more in the nature of quantized ping pong ball than a human who has agendas or incentives in mind.

So how is self-control possible if our behavior is always tethered to incentive? The answer to this question depends

on what we *can* control and what controls us. The ability to achieve rational aims assumes that abilities and aims are rationally determined, and thus human beings, as rational actors should be able to determine then the proper aims and means and follow them with ease. That we do not and indeed, cannot reliably do so or precisely match what is reasonable to what is motivational is the crux of the problem of self-control. From the perspective of a discrepancy theory or incentive, self-control is the ability to pursue not what is objectively possible, but what is *affectively* possible, or merging affect with future possibilities, or as we shall see, *altering* affect through a future well considered. We do this by maximizing pleasure and minimizing pain, and binding it to the positive arousal or 'wants' elicited by the uncertainties of reward.

With the advance of science and the creation of metaphors that allow us to understand in a phrase the nuances of disease, wellness, and health, and adjust our behavior accordingly, a biologically grounded theory of motivation likewise enables us to understand the subtleties of incentive, and to in like fashion predict and control our behavior. Ultimately, how we can manage our behavior depends upon how accurately we can survey and control the likelihood and kind of the incentives that populate our day.

Contingencies and Contracts

In its essence, we *cannot* determine our essential pleasures and we *cannot* determine our essential incentives. We can name, color, shape, and prepare our meals differently, but the food that we eat must have the same carbohydrates and proteins, and likewise, the incentives we pursue must have the same degree of novelty and unexpectedness. For

motivation, our only recourse is to place ourselves in situations where our incentives can find us. For the pleasures of life, this can be as simple as walking into a candy store, a massage parlor, or just a ready water fountain after a long workout. For our day-to-day incentives, if you want to be motivated to hit the books, you enroll in college or take a course, and if you want to be a poet, musician, scholar, or a professional gamer you congregate in the physical and virtual circles of people who will encourage you.

Self-control means the *management* rather than the self-determination of incentive, as the environment we choose determines for us how it apportions a value denominated in uncertainty and import. So the work we pursue, the mates we select, and the entertainments we choose are all contingencies that are contracts both legal, extra-legal, or are bound by custom or habit. How to arrange the incentives that can take our behavior in the direction we want, and how to arrange the incentives that changes the behavior of other people in the directions we want is conceptually easy when we compute the value of incentives that are static in their ability to motivate, no matter when, where, or how they are. But practically this is not true, as our values or norms are not static but relative, and are as dependent upon how they are arranged as to what they are, and are predicated not by their certainty, but by their uncertainty. This means that self-control means understanding how incentives are determined not by their future predictability, but unpredictability.

Future Imperfect

In economics, incentives are like vengeance, and are best served cold, and the goal that is ten years in the future, predictable and frozen in certainty and in time, logically has as much utility as the goal in front of our nose. This assumes that our perspective is clear and unclouded by obstacles. Yet ironically, it is the presence of obstacles that determines whether you will count on the future, or just discount it.

Consider again our solitaire player, if he knew in advance whether he would win or lose, how his fan base would exactly respond, along with a posterity where his fame is certain, and an afterlife where he would be statically affixed forever in the firmament, he would not be joyful, but rather would be bored to tears. Now consider the opposite, where the player receives little or no feedback on his success, his reputation, or the nature of God's favor. Again, the lack of foresight is the same as complete foresight. Only a future imperfected would motivate him, and any event in any time scale would be discounted accordingly relative to how well it gravitates to that golden mean.

Uncertainty not only makes the future a little hazy, but make it risky too, but if uncertainties are placed just right, it can be an engine of motivation. Ultimately, we behave not only because of the objective importance of a goal but also due to the uncertainty of the response that achieves it and the uncertainty of the events it entails. In other words, the momentary value or *decision utility* of behavior is determined by the resolution of uncertainty for behaviors that are directed towards a useful goal, irrespective of whether that goal occurs now or in the future. Therefore future goals are not discounted because of their place in time, but because of their place in the odds.[87]

Because imminently achievable goals are the proverbial bird in the hand as compared to the two in the bush, and assuming that the average number of hidden birds is less than one, the birds hidden in the shrubbery are discounted by their unlikelihood. In economic theory, this makes logical sense, as a rational actor would choose the bird in the hand any day over the discounted value of two birds in the future. Resolving the bird in hand or bush issue is easy when the bush is revealed in only a few seconds, as logic prevails over discrepancy. But lengthen the contingency, make the progress to the goal variable and unexpected, and change the variance of the expected rewards from one to millions, but not its expected or average value (less than one), and an individual's preference is reversed, albeit the logic of choice is not.[88] In other words, rational actors become gamblers, and a future discounted is upended by a present value accentuated by the literal uncertain draw of a card that can for a brief and passing moment point to a royal flush spotlighted by the brightness of affect.

For a gambler, the effective and 'affective' odds can drive an individual to unproductive paths, but we can use probabilities to bend the rules of motivation our way. Indeed, although we can't change our values, we can change the odds, and we can do this in surprisingly simple ways, from merely waiting a bit, to changing our focus on what is plainly before us and fogging up the nature of reality. As we shall see, this requires an element of self-imposed risk and of delusion.

An appetite for risk…

Self-control requires our arrangement of incentives, as behavior slows down to a crawl without them. If there is no reason to live after all, then there is no reason to get out of

bed, do the laundry, or go to work for that matter. Managing incentives is hard if you do not have any to manage, but creating them is quite easy, if we literally take the risk, a choice that we often do, unconsciously, and perhaps more than gladly.

One of the most common ways to control our behavior is to put ourselves in situations where we continually come close to *losing* control. To understand this, consider the behavior of other people both real and fictional whose behavior is most compelling when they are figuratively or literally dancing on a precipice. The prospect of sudden death in football playoffs or action movies where the timer is winding towards zero is scary thing, but it is certainly a motivating thing, and we can be at the edge of our seat apprehensive to the prospect of our team or movie hero, going down in defeat or up in flames. When we play out these close calls in real life, but with stakes somewhat less than mortality, we call this catching the bus at the last second, delivering that report under the gun, and getting to work just in time. All are behaviors that fix attention and excite and motivate, and all need to be jump started by a little procrastination.

'Object' procrastination is defined as the deferment of important decisions or behavior that results in a favored goal that exacts an unfavorable or painful price, or a 'choice-choice' decision. Object Procrastination reflects merely avoidance behavior due to an object being less valued than its painful or subjective cost, or the stressful indecision represented by the indecision of whether to obtain that object or simple defer. There are many occasions that we avoid because they plainly hurt, such as situations or decisions that cause pain, as when an individual postpones a trip to the dentist, uncomfortable household chores, or a

meeting with the boss to ask for a raise. These decisions are exacerbated by the painful tension of just deliberating, resulting also in avoidance. In other words, we can always defer preparing for death and taxes to another day because of their future and/or present discomfort, and feel the better for it as we avoid the anxiety associated with the indecision of going to the doctor or staying at home.

On the other hand, 'temporal' procrastination is defined as the delay or the reduction of behavior leading to important ends that only reverts to attention and intention when the likelihood of a reaching a goal is at risk. That is, procrastination may also represent the temporary deferment or diminishment of the pursuit of an extrinsic goal, and is characteristic of a change in qualitative aspects of behavior that only changes when the reward is on the line. For example, the performance of a sports team against a weaker opponent often has the superior team going through the motions until they fall behind in the score, only to have their focus and behavior pick up the pace figuratively and literally. For temporal procrastination, this delay is not due to the avoidance of the uncomfortable aspects of the culmination of performance, like seeing the dentist or your tax accountant and the anxiety thereof, not is it due to any character defect or flaw, but is rather a function of the lack of positive affective 'tone' of the performance itself. In other words, procrastination is merely the delay or impairment of performance due to the boredom due to a predictable course of action, that only changes when behavior becomes less predictable, as when you move with renewed vigor and energy when the reward is on the line.

In all cases of procrastination, the timeliness of behavior fixes attention where there is little time left. The taxman and

the dentist cannot be avoided forever, and neither can we avoid doing the dishes or completing that homework assignment. Risky behavior is uncertain behavior, and procrastination in any of its forms is simply a non-conscious means of attaining the positive affect that comes with positive uncertainty. Cohering to a discrepancy theory of reward, procrastination is a way of making behavior more rewarding by increasing dopaminergic activity that scales in magnitude with the riskiness and salience of behavior in the moment. As we have noted earlier, dopamine activity not only influences affect, but also performance since individuals think and learn better when they are focused and aroused. The price can be painful, as uncertainty may branch into dilemmas that elicit tension, as the uncertainty in a cliffhanger of a football game, action or horror movie, or just getting your taxes done just in time. Because of the attraction of positive affect, procrastination can not only effect how we decide but what we decide. Thus we make seek out 'just in time' scenarios that have no objective goal at all, but have the 'thrill of danger' in themselves, as devotees of extreme sports from cliff climbing to deep sea diving attest.

It is a pity that procrastination has gotten such a bad rap, because unlike object procrastination, temporal procrastination is merely a timing strategy to *increase* motivation, not to decrease it. Indeed, we all time behavior so that when we get started, whether it is running late for work or staying late doing work, the moment-to-moment discrepancy or touch and go nature of behavior motivates us, and we end up being more focused and productive than if we approached goals at our leisure. Besides, the arousal of the chase, or being chased, is a positively affective thing,

even if it is attached to a bit of indecision and tension when our estimates prove faulty, as they invariably do.

… and for delusion

Returning for a moment to our doe in the field, we know that the doe must make good decisions without having to think all that much, which it couldn't do anyways. If it has the wits of its canine cousins, it could scout around for the best places for shelter, water, and so forth, but in the meantime, it would follow its peers, or its herd instincts, and would rest assured, as its rests, assured, that it made the right choice.

Self-control means making right decisions, but reason has its limits, as we are not built to following rational paths that require constant criticism and correction. We simply have neither the time nor the wits for it. Associative learning informs and enforces an inductive perspective of the world that is our default way of thinking. We learn cause-effect relationships from our own experience, and as importantly, from the collective experience of others, and when the group moves right, we assume that it knows it's right, and group norms from cultural mores that prescribe standards for personal behavior to cultural traditions such as religious or political beliefs become the compass that guides our behavior. We assume that underlying all of this are perfectly rational explanations for our behavior, when indeed we are only following the trend lines laid out by habit. And with this assumption we are wrong.

The problem is that for inductive reasoning, there is no cause and there is no effect, there are only correlations that we use to *infer* cause and effect. This was the argument of the Scottish philosopher David Hume in the late 18th century, who maintained that it is a fallacy to adduce deep

explanations to rudimentary correlations, or in other words making inferences of how things work or the nature of their reality through simple correlations of events.[89] Induction follows Occam's razor, that the simplest 'explanation' is the right one, or more to the point, missing the point that explanations are never simple. Occam's razor may thus be restated to mean that the simplest *correlation* is the reliable one, even though logically the correlation is quite far from an explanation. Simple correlations when reliably maintained quickly become heuristic principles or rules of thumb that in popular opinion suffice as explanations, but this is a delusion. Still, delusions have a habit of becoming suggesting truth if the correlations take unlikely paths.

For example, take a random number generator that produces numbers from one to six. If the generator produces seven number fives in succession, then one can weakly presume that there is an error in the machine, and with equal weakness in logic presume that given the law of averages, any number other than five would be due. This latter 'gambling fallacy' represents the fallacy of inductive reasoning, that correlations prove the rule. Still, although correlations may not suffice as explanations, at least they can suggest a ghost in the machine, as a generator malfunction or other cause may be adduced to the machine if it produced five hundred returns of the number five in a row. Likewise, if millions of our compatriots are afraid of righteous God, then the seemingly unlikeliness that all these people can't be wrong can suggest a different type of ghost. Humans are primed to follow correlations, as they are the quick and convenient way to make decisions that are *generally* correct without the time-consuming effort to deduce real explanations for a phenomenon that can make general predictions rather than specific ones. Indeed, to

understand cause and effect you must have *explanations* for why things happen, or multiple converging and self-correcting perspectives or levels of observation. For example, to see a flock of black swans flying overhead each morning leads to the working correlation of black swans flying by daily. This tells you nothing about why swans are black, where they come from, where they are going, and why they are going in the direction and speed, and how they can fly and even exist in the first place. Knowing everything about swans and the world they live in gives you *explanations* of swans, and with explanations you can predict far more accurately the behavior of swans, from where they are going to where they are nesting in the winter to how they flap their wings, and of course, why they are black. Similarly, we use multi-metaphorical perspectives on behavior for the deep explanations we have from biology to physics, and with those explanations can make many diverse predictions about the nature of the world and how we can manipulate that world, from vaccines to rockets.

Yet, in spite of the power and importance of explanation, in an age of reason our behavior is primarily based on faith, or the fact that things work out the way they do because they just work the way they do. All matters of faith are matters of induction, and for the most part, almost everything we do is a matter of faith, whether it be in our institutions, our religious beliefs, or the products we consume and the machines we use. Faith after all is not subject to observation, refutation, and test, particularly when we have neither the time nor inclination for it, and by its impracticality at least is impervious to deductive method. But we trust it, and have good reason to, until it steers us wrong. Faith may not move mountains, but it moves minds, and the moods that make up and unduly change our minds.

Placebos and their effects

We are at turns excited and depressed on the prospect of good or ill fortune due to the choices we have made or will make. Successful choices can set us on the straight and narrow or just confirm that we are on the right path, and the resulting expectancies confirm not only the direction of our behavior but the quality of our mood. The question is, what is it about our choices that make our feelings? The answer is, we more often than not just don't know.

Oftentimes we misattribute our mood from arousal to depression to pleasure to pain to *normative* rather than *abstract* elements of a situation, or what they are like rather than what they are. It is here that we misattribute the source of our feelings, a factor that changes in turn the perceived source of our values. This is what is called the 'placebo effect', or powerful or long-lasting affective states that are misattributed to incorrect causes. When we think of placebos, what comes to mind are the harmless sugar pills that are prescribed by doctors to unknowing patients who are cognizant of the promises but not the quality of their medication, but are thus relieved of anxiety and bestowed with good feelings that to them signals a cure. The resulting pleasure and arousal of just the confidence of a cure has an analgesic effect[90] which is often enough to set a patient on course for a full recovery that would have nonetheless occurred given the general course of disease. Placebo effects are at root delusional, but this same delusion or misattribution of affect influences nearly everything we eat, think, or do.

For example, a parishioner who listens to a fiery sermon may feel filled by the holy spirit, when in truth his feelings are hardly unique, and reflect the arousal and pleasure associated with an implied confidence of a spiritual rather

than a more prosaic cause. The most common form of placebo effect occurs in the literature and practice of self-help, or when it is administered by others, as with psychotherapy. Psychotherapies or talking cures, represent a bewildering array of linguistic treatments from Freudian psychoanalysis to cognitive and behavioral therapies, and ebb and flow in popularity with the tides of fashion. The problem is that in numerous studies, individuals with psychological complaints all respond in similar ways across all psychotherapies, with no difference between them, none.[91] All psychotherapies seem to work or can be 'proven' to work since none control for affect due to delusion, as a therapist may be deluded as well.[92] The short-term effects of talking cures, from motivational speakers to your local preacher to motivational tomes from scripture to philosophy to self-help books is called inspiration. And if inspiration promotes outlandish and unusual behavior unsupported by common norms, entirely unique mental or 'hypnotic' states are often hypothesized to account for them.[93]

The placebo effect reflects the predictive and affective power of expectancies that are beholden to no special cognitive power save the perceived reliability of information. Placebo effects occur when we misunderstand how information mediates affect, but its converse can occur when we commonly misunderstand how affect mediates information. Or in other words, if it merits excitement and attention, it must be important. The result is that we often confuse the affective value of information with its rational value,[94] as when we continually check stock market listings, email, or social media for information of negligible momentary value.

Delusion is a poor substitute for incentives realistically perceived and carefully applied, as the ministrations of self-help gurus, preachers, teachers, and the motivational aphorisms from friends and kin abruptly and invariably fail. Still, to be dissuaded of the reality of pots of gold at the ends of rainbows, particularly if the gold is served up only in an afterlife may serve little purpose to those who pin their hopes on caring deities. So we are careful in the delusions we may wish to challenge, and dispute earthly presumptions with heavenly ones to be left in their place, leaving even skeptical minds devout. For our mundane concerns, we are often bound to delusion, but are far less likely to be bound to accept it, particularly if their predictions go astray, as invariably the bright horizons of inspiration have to face the cliffs of reality. Ultimately, to master self-control we must maximize our gains, and to do that we must minimize our delusions. How we can do that means learning how to face reality with calmness and confidence, an ability that is much easier than one may think.

A Note on Habits

From a logical point of view, decisions are the result of conscious or non-conscious calculations, but this is at root an irrational premise, as the calculus of decision making, if followed rationally, would be as complex as an actual mathematical calculus, as we would have to consider every alternative that was equally useful. Even in our evolved state, we have neither the wits nor intelligence to follow this computational scheme. To minimize the need for constant figuring, nature has figured out a way that at once simplifies decision making and yet to many of us, confounds it. Because we can't keep track of all meaningful correlations,

we non-consciously dispense of the redundant ones. This is not done by rational choice, but is a built-in feature for mammals as well as humans, for without it we would be overwhelmed by the static of infinite relationships. Nature calls it blocking, but in commonplace usage and practice, we call it 'habit'.

For almost all of the day-to-day behaviors that give us sustenance and keep us on the straight and narrow, from respiration, walking and talking, to just sitting up straight, we are responding to and are guided by events that register barely in our consciousness. We also have the ability to be aware of and to pursue countless behavioral alternatives, from driving to the store to contemplating the next day at work, that we decide to do because of their rational value, or declarative reasoning. However, these choices are not just rational but are affective too, and are non-consciously perceived when our attention is given to daily choices, and specifically if the choice has highly positive novel consequences due deprivation (hunger) or high cognitive salience (a monetary reward). This affective precursor and modulator of attention is mediated by dopamine systems and is called 'priming' or 'wanting', as its folk equivalent of 'looking forward to' an event provides extra guidance or impetus for behavior due to the increase in the value of the moment to moment 'decision utility' that affect provides to focus our attention on a goal.

However, priming effects can be dissociated from the rational calculus of cause and effect, causing us to be aware of the rationality and even attractiveness of alternative choices, but attend regardless to the tried and true. This represents the concept of 'blocking'. Discovered in 1968 by the psychologist Leonard Kamin and replicated in numerous experiments with laboratory animals,[95] Kamin

found that animals, and by extension humans, are not sensitive to learning redundant correlations, and are sensitive instead to novel correlations. For example, if one associated a red light with stopping at a traffic intersection and notices also a blue light that suddenly turns on concurrently with the red, one would continue to attend to the red light, with the blue light, which is presenting merely redundant information, being ignored. Not only learning about the blue light's relationship would be impaired, but *attending* to the blue light will also be inhibited. The inhibition of priming effects for otherwise redundant act-outcome relationships is equivalent to 'habit'. Habits are *not* motivating forces, but represent act-outcome expectancies that may have *logical* salience because of their affective outcomes, but not *affective* salience for the responses that lead to those outcomes. For example, eating sushi and fried chicken for breakfast has an affective outcome or 'liking', as it tastes the same regardless of when we consume them. However, the affective responses that lead to them, or 'wanting', are inhibited in favor of our wanting foods we normally associate with breakfast, like bacon and eggs.

Habits demonstrate that not only is wanting dissociable from liking, but can be also enhanced or inhibited by experience, information, or learning. So we may be aware of many things we should like, but don't want, which is a function entirely of learning. Eliminating wanting or priming effects is generally a function of following the correlations of life, as we tend to do and are primed to do what we have always done, even if there are other alternatives worth consideration. But priming effects can be easily inhibited too. For example, learning that a person you may be dating is a sibling is enough to make sure that you

are promptly 'unprimed' to be aroused by that person, as Oedipus in Greek mythology found out the hard way.

The correlations that create habits can also be consciously manipulated to indirectly motivate behavior by removing its affective impediments. For example, the continuous distraction of 'choice-choice' alternatives between the affective choice of accessing one's email versus the rational choice of staying focused on work can be eliminated by modify one's 'wanting' to access email. By continuously restricting access to email except for times after work, then the priming effect of attentive arousal will fade, or extinguish. Thus by building a habit of avoiding distractions and their attendant effects of stress, we are able to pursue our primary goals.

So in sum, 'blocking' means that you never learn to be primed to a redundant relationship, while 'extinction' means you unlearn it. With the addition of habit we see that act-outcome behavior can be selected, non-selected, and de-selected, and we behave because of the continuous interweaving of affect and reason, and without affect, behavior is inert, and without reason, behavior is blind.

Parsing Happiness

"Finally, all might agree that happiness springs not from any single component but from the interplay of higher pleasures, positive appraisals of life meaning, and social connectedness, all combined and merged by an interaction between the brain's networks of pleasure and meaningfulness. Achieving the right hedonic balance in such ways may be crucial to keep one not just free of distress— but even to achieve a degree of bliss."- Kent Berridge[2]

How do you make a lion, a tiger, or a bear happy?
Simply put, you just meet their needs. Give them food, drink, a proper mate, and they will be happy. Well, almost. They also need the ability to roam freely in an uncertain environment. If not, as zookeepers would attest, the best cared for animal would quite literally go mad.
Animals know their needs are met because they can *feel* them being met, and feelings are *affective* states that are mediated by specific neurochemicals in the brain. The pleasures of life, from food[96] to relaxation or rest,[97,98] are mediated by the activation of opioid nuclei in the brain (i.e. neuronal groupings in the midbrain), whereas a feeling of

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[2] Kent Berridge and Morten Kringelbach, Building a Neuroscience of pleasure and wellbeing, *Psychology of Well Being: Theory, Research, and Practice 2011, 1:3* : **http://www.psywb.com/content/1/1/3, 2011.**

alertness or arousal (but not pleasure) is mediated by dopaminergic nuclei that are activated by the experience or anticipation of novel or unexpected events that have positive outcomes, and scale with the importance or salience of those events.[99] Both opioid and dopaminergic neurons are located in adjacent locations in the midbrain, and opioids have an excitatory effect on dopamine systems and vice versa.[100] [101,102,103,104,105] [106]Thus, not only do opioids increase dopamine levels; but opioid activity is enhanced due to dopamine activation, as also attested by self-reports of greater food palatability or pleasure under conditions of positive uncertainty.[107]

This interaction is particularly significant when we induce relaxed states either consciously (through relaxation protocols such as meditation) or non-consciously (thinking of nothing while looking at a sunset) and concurrently are aware of imminent positive or meaningful events or behavior. This would result in a heightened feeling of pleasure *and* arousal. In other words, the opioid and dopamine systems activated in rest and attentive arousal interact *synergistically*, and their combined effects are greater than the sum of their separate effects. Maximize both concurrently, and in the case of animals at least, you will have a very happy critter.[3]

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[3] The neurobiology of this observation is relatively simple. It is of note that amphetamines (which increase dopaminergic activity) also increase the release of endogenous opioids, and the latter scales or increases with amphetamine levels. It follows that cognitive events that increase dopamine activity (highly interesting or engaging tasks) will also result in similarly elevated levels of opioid activity in an activated (eating, resting) or non-suppressed state, with self-reports of high pleasure and attentive arousal, or 'ecstatic' states. In other words, dopamine induction

For human critters, we are distinctively different from animals because of a large neo-cortex that allows us to virtually render behavior and its myriad uncertain outcomes. In other words, we can mentally rehearse or think through options and their outcomes prior to choosing them, thus giving them meaning. Depending upon whether these outcomes are positive or negative, the activity of dopamine systems will either be enhanced or depressed, and dopaminergic activity will also scale up or down with the importance of real and virtual outcomes gained or lost. We will define 'positive meaning' as the branching positive implications of behavior as perceived *virtually*. For example, recreating the super bowl on a video console has little meaning, but watching the real super bowl does, and doing a good deed, earning a degree, or completing a work of art bestows a sense or 'feeling' of honor, pride, or achievement that represent ever refreshing positive meaning. Contrariwise, behavior that is positively affective in the moment (overeating, watching TV in lieu of chores) may have branching *negative* implications that are also virtually perceived. This 'negative meaning' suppresses dopaminergic activity and is felt as the emotion of regret or depression, and the same reduction in dopamine also suppresses opioid activity, resulting in a reduced ability to experience pleasure, or 'anhedonia'.[108] We want to consider past and present behavior and the emblems of that behavior

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during non-stressed states, or resting states, will increase baseline opioid activity that is unsuppressed by anxiety or tension, and scale with the level of dopamine release. See Calipari et al. (2013) and Colasanti et. al (2012) articles linked in references.

(trophies, rewards) to have positive and meaningful cognitive import that branch into endless positive and affective implications, that will in other words 'echo into eternity'.[4] When combined with the pleasurable affective state of rest, a maximal state of pleasure and alert arousal will be achieved and will scale with the importance or salience of moment-to-moment goals and their virtual implications. These facts lead us to redefine rest as representing not a static but a *dynamic* affective state, as the opioid systems activated in rest are always positively or negatively modulated by dynamic or phasic changes in dopamine systems that are induced by concurrently perceived positive act-outcome discrepancies or expectancies.

The subtle but major flaw in most resting procedures (e.g. meditation) is that they eschew positive meaning, and diminish or dismiss the alert arousal that humans instinctively require to live productive lives, escape the pangs of boredom, and enhance the affective entailments of

[4] It is to be noted that the salience of the positive virtual branching implications of a behavior, or its meaning, is always dependent on one's history of reinforcement or reward. This behavioral 'contrast' demonstrates how previous expectations can raise or suppress the meaning of behavior to come. Thus, a fan of the Cleveland Browns would find a win for his team in the Super Bowl more meaningful (and more rewarding) than a fan of the New England Patriots, who has come to expect and predict such things. Similarly, a millionaire reduced to bagging groceries for a living would find his behavior far less meaningful or rewarding than a central American refugee is a similar state of need.

relaxation.[5] Conversely, a life of positive meaning but full of irresolvable conflicts eliminates the pleasurable state of relaxation and replaces it with the pain of tension or 'stress', and later regret. Contemporary philosophies of life commonly separate the two, as if pleasure and purpose are entirely separate and often conflicting goals. Quite the opposite, they are interdependent.[6]

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[5] This underscores a major flaw in meditation research that it does not address the *affective* component of meditative states, which clearly implicate relaxation and states of alert arousal and the perceptual events which elicit them. Meditation research generally relies upon comparative self-reports of meditators and non-meditators, or fmri (functional magnetic resonance imaging) or brain scans that measure cerebral blood flow. However, neither can isolate the neuro-muscular and neuro-chemical activity that correlate with subjective affective states, or how neuro-muscular activity is a function of cortical activity as mapped to experience or learning. Because these research methods and tools cannot determine the etiology or source of the positive affect associated with meditation, it is no surprise that meditation remains without an adequate explanation.

[6] The study of the affective concomitants of a meaningful and focused engagement with the world is not new, and finds it best contemporary advocate in the work of the humanistic psychologist Mihaly Csikszentmihalyi, who coined the term 'flow experience' to reflect self-reports of artists, athletes, and other individuals who uniformly reported a very intense and positive affective state when engaged in tasks that had very high and consistent meaning that engaged their undistracted attention. The twain meets of course when our 'bottoms up' approach to affect interlocks with Dr. C's 'top down' perspective, which although highly metaphorical in nature, nonetheless conforms to neurological truths. A much more detailed analysis of the flow experience is found on pages 196-201 of this book.

Wither Meditation

The blessing and curse of intelligent life is that we are always trying to make some sense out of it. We don't wait for things to happen, and instead are quick to model myriad as-if or transitive events. It is a sign of intelligence, creativity, and a source of our happiness as well as our woes. As a prerequisite for rest, the avoidance of cognitive perseveration (i.e. persistent worry, rumination, distraction) means that perseverative thoughts are not experienced at all, and to achieve this it logically follows that the as-if cognitive operations that may segue into perseveration must be reduced or inhibited. This is the rationale for thinking in the present tense, or 'in the moment', which is the core definition of mindfulness. Mindfulness avoids perseverative thought by radically reducing the idle strands of predictive thought or undirected, 'mind wandering', or discursive thinking that can lead to cognitive perseveration and its manifestations of worry, distraction, and regret. During mindfulness sessions, by consistently focusing on the moment, or being mindful, as-if cognitions are inhibited, perseveration is avoided, and relaxation is achieved. *Mindfulness is the habit of continually thinking in the present tense*. As a means of mental hygiene, mindfulness implies that the default mode of a happy life is a still life, a timeless life. But therein lies the rub. As we have noted, humans are imbued by evolution with an instinctive 'seeking' response that leads us to seek novel outcomes, and optimally, to seek a cascade of virtual future positive and novel events or 'meaning'. Thus, to be mindful is not enough, as being mindful alone ultimately invites boredom. Thus mindfulness is a practice that can only be intermittently applied before one surrenders again to the siren's call of distraction, and begins

the Sisyphean process of a relaxed high followed by a stressful low. But to make meditation sustainable and increase its affective 'tone', a type of judgment must be introduced to follow it, and by doing so increase our ability to better manage our behavior, or self-control.

Self-Control

The concept of self-control denotes the rational consideration and discovery of the expected consequences of pursuing a course of action, or its expected utility. Thus our behavior can be shaped by our own volition as rational actors. These consequences, when considered in real time as inspiration or 'meaning', have affective value and reinforce moment to moment approach behavior. However, the 'decision utility', or the value in the moment of a course of action, is also affective, and can be in line or at odds with the long-term goals or expected utility of a course of action. Thus one can pursue the long-term goal of productive work and still be diverted or distracted by stimuli (social media, rumination and worry, web surfing, small talk at work, etc.) that have little or no long-term value or meaning. This often causes tension and stress as one has to continually choose between choices of incommensurate value, or in other words, between distraction and productive work.

The logical answer to this problem is to increase the decision or moment to moment utility of behavior that is coherent with the expected or future utility of performance by increasing the former's affective value. In other words, by making productive work artificially more enticing in the moment, it is easier to crowd out distraction and focus on important tasks. We often non-consciously do this by waiting until the last second to accomplish a task, where

moment to moment success is touch and go and elicits attentive arousal or excitement. In other words, we procrastinate. From heroically defusing the bomb in time to merely catching the bus on time, from our entertainments to our most banal day to day behavior, through the timing of our behavior we calibrate affect to induce the responses we logically need. A preferable approach to self-motivation or self-control without putting our behavior on the razor's edge of procrastination is not just making moment to moment productive behavior more arousing, but also more *pleasurable*. To do that, we must first get relaxed, and that is where mindfulness comes in.

Mindfulness reduces or eliminates 'mind wandering' or discursive thinking, or the random ideation or thoughts that can easily transition into conflicted or perseverative thought (regret, distraction, worry) that is embodied by depression or anxiety. It also induces relaxation, which is pleasurable. This pleasurable state of relaxation in turn can be enhanced during meditation sessions through its association with an awareness of subsequent non-discursive or purposeful thought, or 'affective priming'. In this way, the affective tone or 'feeling' of mindful or relaxed states increases through the synergistic effects of aroused and pleasurable states. In addition, the decision utility or present value of moment-to-moment meaningful behavior increases, and with it 'self-control'.

Thus, to maintain a productive, stress free, and pleasurable day, the avoidance of all distraction, worry, and regret through the elimination of its precursor of undirected or discursive thought through mindfulness (or thinking in the present tense, or 'in the moment') combined with the priming effects of conscious or non-conscious anticipation or awareness of non-discursive purposeful or meaningful

behavior occurring subsequent to meditation allows us to understand and face the reality of the incentives that drive our emotional (covert) and overt behavior, and through arranging them, control them. Because relaxation can become a constant factor in our lives, it also acts to inhibit the tension that would occur for active perseveration when dilemmas intervene, thus allowing us to focus more on behavior that counts. An awareness of subsequent meaningful behavior subsequent to meditation also acts to *accentuate* good feelings by increasing the pleasure of relaxation through increasing positive uncertainty or discrepancy during the practice of meditation, or affective priming.[7] Conversely, this gives affective value to

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[7] *From Procedure to Priming, in a nutshell*

Procedure: Frequent switching or alternation (generally within 30-60 minute intervals) between a resting protocol (e.g. mindfulness) and the pursuit of meaningful behavior will increase motivation and positive affect (arousal and pleasure).

Explanation: Resting elicits opioid activity, or feels pleasurable, and meaningful behavior, as defined as behavior that has branching novel and positive outcomes (writing that great novel or just making the bed) elicits dopamine activity which causes arousal. The awareness of subsequent meaningful behavior while engaging in relaxation protocols such as mindfulness elicits a 'priming' response, namely dopamine release that increases opioid activity, and vice versa, making meaningful behavior seem self-reinforcing or 'autotelic'.

Although mindfulness reduces discursive thought; it does not inhibit concurrent non-conscious awareness or anticipation of behavior or events subsequent to meditation that can in turn shape or 'prime' affective responses during a meditative session. A priming response, like the salivary response that precedes food

meaningful behavior, and makes it seem 'autotelic', or reinforcing in itself, and crowds out the occasions we might have spent dwelling on other worries and concerns.

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or the sexual arousal that precedes intimacy, is a preparatory response that often occurs non-consciously, and changes the affective value or 'feeling' in the moment. Similarly, relaxing or 'being in the moment' is pleasurable, but if we were told to expect 'bad' news or 'good' news in the near future, just the awareness of future events is enough to depress or elevate our feelings, but not altering in the slightest our 'mindful' or relaxed state. It follows that if mindfulness is paired with the awareness of subsequent positive or meaningful behavior, then rest in mindfulness will have a greater affective tone or 'feel better' than if such a prospect was absent. This is perhaps why 'savoring', 'loving kindness' meditation, and 'flow' experiences represent highly pleasurable and arousing experiences that map positive ideation to relaxed states, and can be contrasted with a lower level of pleasure during typical states of rest that generally precede a return to meaningless discursive thinking.

Another way of describing this procedure is as 'acceptance and commitment', wherein one is aware of the slings and arrows of outrageous fortune, but accepts them as facts without proceeding to contest, reinterpret, or remediate them through rumination, worry, or regret, while concurrently aware of meaningful behavior to come. In other words, acceptance inhibits discursive or 'what if' thoughts or 'mind wandering', and implicitly entails rest through its avoidance of cognitive perseveration, while commitment represents an awareness of the imminent pursuit of meaningful behavior.

The Happiness of Pursuit

Happiness is an elusive concept, but if perceived through the prism of affect, can be defined simply as continuous arousal and pleasurable affect that emerges from a meaningful and restful life. Happiness is in other words a motivational constant, and is a dynamic rather than static state. **Happiness is living a life of undistracted and persistent meaning**. It is the synergy of pleasure and arousal that emerge from rest and positive meaning, or as Berridge would describe it, 'a degree of bliss'.

This notion is in fact not new but finds its origins in the philosopher Aristotle's concept of eudaemonia, which adduces arousal and pleasure to a life lived according to reason. From his Nicomachean Ethics Aristotle argued *that eudaimonia, or living well, consists in activities exercising the rational part of the psyche in accordance with the virtues or excellency of reason Which is to say, to be fully engaged in the intellectually stimulating and fulfilling work at which one achieves well-earned success*.[109] The metaphorical concepts of 'stimulating' and 'fulfilling' can be mapped to arousal and pleasure centers in the brain that are activated not by some inner virtue or capacity, but through outside incentives as arranged by an individual and the primary (family, friends) and societal institutions that he selects or which select him.

To love and do productive work was Freud's maxim for happiness, our similar notion is rather to relax while doing productive work. Both are intoxicating, but the latter requires an easier route for the pleasures which animate our life. Ultimately, self-control is not the secret to happiness, it is happiness itself, and comes free of complexity, controversy, or cost.

Bonfire of the Vanities

In Renaissance Florence in 1497, the prelate Savonarola roused the citizens to put their vanities in a heap and set them on fire. "The focus of this destruction was on objects that might tempt one to sin, including vanity items such as mirrors, cosmetics, fine dresses, playing cards, and even musical instruments. Other targets included manuscripts of immoral books, secular songs, and artworks, including paintings and sculpture."[110] What eventually was set to light was Savonarola's vain beliefs, which the Florentines upon recognizing their folly promptly rectified by burning him and two of his followers at the stake.

Savonarola: Authoritarian figure

Bad ideas unfortunately are set on fire, along with the noggins of those who espouse them, a bit too late for most folks, who must suffer world wars, persecutions, famines, bad governance and other catastrophes along the way.

Until then, they don't know until with the virtue of hindsight that they have been deluded.
Delusion is after all a matter of having a cloudy perspective on reality, and sometimes when you want to see clearly you just need a better pair of glasses. Humans love to think of themselves as having a special place in cosmos, or at least in God's eye. Whereas the deity may at turns coddle us with miracles or discipline us with fire and brimstone, mother nature just allows us to stand on our own and see things as they are. Nature ignores us, but at least God provides succor to our vanity, and He did that by making a world in just seven days and dabbling from time to time in the affairs of men. Naturally, mankind was at the center of all the attention, and the planets, sun, and stars dutifully rotated about the earth, each affixed on invisible rotating spheres of crystal. With the use of instrumentalities that could bring into focus the hazy outlines of the very large and the very small, scientists from Galileo onwards collapsed the myriad illusions of reality into one clear picture. The social sciences are the last refuge of resistance to a similar reckoning with reality, with an upending of not just psychological science, but of our economics, our politics, and our very concepts of good and evil.

Eclecticism

"Psychological theory today is a patchwork, much like the mosaic of principalities that eventually became Italy and Germany circa 1870. A major goal for all theorists must be to integrate what exists rather than to neglect or denigrate the rest of psychology. Connecting theories conceptually exposes our mutual blind spots and can lead to new and bold insights." [111] Gert Gigerenzer

"Those who believe that prudence and common sense demands that one must avoid a commitment to any particular research

strategy fail to realize that such a belief constitutes a commitment to a definite research strategy-the strategy of eclecticism. This strategy scarcely qualifies as prudent or scientifically sensible. By picking and choosing epistemological and theoretical principles to suit the convenience of each puzzle, eclecticism guarantees that its solutions will remain unrelated to each other by any coherent set of principles. Hence eclecticism cannot lead to the production of theories satisfying the criteria of parsimony and coherence. Rather, eclecticism is a prescription for perpetual scientific disaster: middle range theories, contradictory theories, and unharmonious theories without end."[112] Marvin Harris

The reality that we must confront is of direction, of where we want to go, what we want to be, and how we are to get there. All of these questions hinge on our understanding of what incentives are and how they make us be. And by understanding our motivations we can narrow the many roads to truth to one, but at a cost of the alluring aspects of the dead ends of knowledge.

The collapse in the eclectic structure of *all* the social sciences, from anthropology to sociology to economics occurs with a uniform explanation of incentive. Until now, the social sciences have had no unifying biologically rooted description of how motivation works, and have condemned themselves to the same eclectic procedures and theorizing that fills journals yet scarcely informs explanation. Certainly, we have no nostalgia for the wrong turns of science, from Galen's biology to Aristotle's physics, yet the disjointed eclecticism of the past certainly gave a liveliness to intellectual discord that fills journals and classrooms and incents with the prospect of social influence, prestige, and tenure. But we have been there many times before.

Before the biological revolutions of the 19th and 20th centuries medicine was notoriously eclectic, and diseases

could result from the confluence of any number of real and obscure causes, from demonic possession to bad air. Some of the treatments for these maladies worked, most didn't, and the explanations provided were always confined to the symptom at hand, which expanded into a recipe book of causes and cures that were un-united by explanation. By the 20th century this eclectic approach to health was replaced by the simple governing principle that health and disease must be mapped to micro-biological events that can be observed. In the 21st century, for affective neuroscientists at least, the eclectic approach to motivation was equally united under the similar premise that incentives can be mapped to bio-behavioral processes that are also observable. How those processes could be practically extended to the motivational principles that guide humans is a question as yet unattempted, as affective neuroscience has yet to 'escape' from the laboratory, or move from specific to general applications that can confirm or disconfirm practical procedure. And it is procedure that unifies, simplifies, and ultimately displaces other fashions of thought not through rarefied standards of truth but through simple pragmatics. Thus it didn't matter if anyone understood your explanation for malaria, for if spraying for mosquitos worked, than your explanation would be accepted on its merits, not its logic. Even Einstein was vindicated and popularized, not by his theories, which few can understand even now, but through the verification of his simple predictions.

Beyond the confines of psychology as covered in this book are the social sciences from economics to politics that are broken into myriad schools, sects, or parties that also collapse under the resolving perspective of how motivation

works, and ultimately changes our perspective of good and evil and freedom itself.

Economics

Incentives are the cornerstone of modern life. And understanding them-or often, ferreting them out – is the key to solving just about any riddle, from violent crime to sports cheating to online dating. -Steven D. Levitt and Stephen J. Dubner[113]

The term *homo economicus*, or economic man, is the portrayal of humans as agents who are consistently rational, narrowly self-interested, and who pursue their subjectively defined goals optimally.[114] Similarly, in folk psychology the governing assumption is that we are motivated to master the means to achieve control over people, places, and things, with consumption as the culmination of incentive. Achieving this we employ the infinite palette of behavior, from painting the vault of the Sistine Chapel to robbing a bank. In classical economics, the values or 'utilities' of life are diverse, but in general are classified as physical objects. This makes them easy to measure and quantify. In classical economics utilities are real consumable events, and are subject to many objective metrics, from GDP to consumption rates to the size of our swimming pools.[115]

But as a measure of man, this metric is misplaced. Utilities *are* in essence the same, but they are not what economists as well as the public think they are. As we have demonstrated in this book, affective neuroscience tells us that utilities, rewards, or reinforcers are primarily *virtual*, not real, and reflect the shifting *potentiality* of consumption and control, a potentiality for events whose consumption may be infinitely postponed and therefore infinitely generated. Consuming them only resets the potential for the next goal in the horizon, and is an often-pleasurable waypoint, but

not the true goal. Potentiality is therefore an unlimited good because it is visualized, but rarely realized. In other words, economic goods are infinitely *deferrable* goods, and if we do not have to take delivery, we can live on promises alone, and indeed thrive on them. In other words, the purpose of life is to have our cake, but to virtually eat it too! So, the key for economic prosperity is to generate promises that we deem and choose to be deferrable. Ironically, life is best run as perfected Ponzi scheme where the payouts never come due, and promises build upon promises, with virtual castles being forever built in the sky, untested by anyone so bold or foolish as to take a seat in the clouds.

The goal for individuals is to eliminate negative affect (pain, boredom) and to elicit and sustain positive affect (pleasure, arousal). This is accomplished through the reduction of contrast and conflict and through the multiplication in time and space of incentive. Or in other words, happiness is but to live a focused and meaningful life. These goals are accomplished not by changing the *normative* (what we strive for) but the *abstract* ends of behavior (how we strive for it). Humans are utility maximizers indeed but have defined utility all wrong. Indeed, if utility is measured through *deferred* rather than actual consumption, this conforms to a philosopher's ideal, where a life of meaning is the best indicator and source of a happy life.

Perfect societies are a matter of design, and as social, technological, and natural environments change, must be endlessly corrected by criticism. Evolution provides the natural inducement for variability, selection, and change, and so too must cultural evolution through consistent self-examination and criticism. Criticism must be through incentives for the active engagement of citizens in the body

politic, and through our familial, educational, and social institutions.

The continuous estimate of possibilities is not measured in real objects of consumption, by in the virtual objects measured by our conscious and non-conscious presumptions, and there can be no scarcity of virtual goods unless made so, as they too often are, by defects in the cultural designs that create them. Economics and psychology nonetheless remain strange bedfellows, with incentives still regarded practically, cognitively, but not affectively.[116]

Politics

"So perverse is mankind that every nationality prefers to be misgoverned by its own people than to be well ruled by another."
— Charles James Napier

In political theory, physical and social goods are scarce commodities, and they must be rationed and apportioned according to individual worth and need. The question is, who is to administer them, the individual or the government? Does the invisible hand of the market apportion these wisely, or does the iron hand of governmental bureaucracy? This is an impossible calculus, with eternal tension between who can and who knows how to balance each, with the scale sometimes tilting left and sometime tilting right. However, if these goods were free, only the efficiency and staging of their distribution would be of issue, with everyone assured to get their desired share, at the right place and time. In this case the issue of individual equity and responsibility that drives the distinction between conservatism and liberalism would be moot. The governmental or individual provision of the physical needs of food and shelter are not an issue in an age

of mass production, energy efficiency, and automated distribution. What is left are the incentives we design to make use of them to affect our relative control over each other. Individual status or influence is volatile, and has many markers, from the ability to jump higher, hit balls better, move chess pieces with greater skill, or simply sing or compose a better song. In short, life is meaningful through the effective provision of incentive, and properly designed, incentives are infinite, plentiful, and free. Therefore, in an age of plenty, tension between the individual and the state is a simple matter of how to effectively distribute and stage the virtual goods of approval and regard. From our previous example of Shakespeare, this could be as simple a matter as constructing a theater, but in a present age of myriad competing distractions, only those that have the longest tail, or extended meaning have the greatest incentive value, as they continue to arouse our attention and pleasure long after they have passed. In other words, successfully storming the beaches of Normandy is a passing diversion if done on a video game, but is a source of emotional satisfaction for those who have endured it that lasts a lifetime.

Therefore, it is to the interest of individuals and governments to design and foster meaningful incentives. This means encouraging accomplishment in the private and semi-private confines of family and community that have resonance not just for the moment, but for the ages. The foundation for this is incenting the development of basic skills required to navigate a complex technological world, and the incentives to enhance and hone them through continuous criticism both from the individual and the

society at large. Par for the course if you want to mold a Shakespeare, and reciprocally, the demands of his audience.

Good and Evil

In 19th century India, the British Commander Charles James Napier, when confronted with the tradition of suttee, or the burning alive of widows on their husband's funeral pyres, proposed a penalty commensurate to a crime that was couched in the matter-of-fact coexistence of two customs.

"Be it so. This burning of widows is your custom; prepare the funeral pile. But my nation has also a custom. When men burn women alive we hang them, and confiscate all their property. My carpenters shall therefore erect gibbets on which to hang all concerned when the widow is consumed. Let us all act according to national customs."[117]

Good taste, whether it by taste or smell, or marks preferences for the beautiful and disregard for the ugly are affective judgements. When they pertain to the behavior of individuals, attraction can scale to passion and repulsion can descend to disgust. Affective values are engraved in everything from our food menus to our political constitutions, and with them come our appellations of the beautiful and the ugly, the tasteful and the tasteless, and of good and evil.

Good and evil are simply the affective ways in which we weigh preferences. This means that good and evil are not logical but *affective* realities. Thus emotionally, an actor becomes a malefactor depending upon the situation, and how we would have reacted if they *should* have known better. For example, a driver of a car that collides with your vehicle would be excused from your rage if a stop sign at an interchange was hidden from view, would incur your anger if he was inattentive to the stop sign, and your feelings

would be beyond the pale if he ignored the stop sign because he was a member of a cult that disbelieved in traffic signals. And even when emotions cool, retribution follows custom, as a customary commission of war crimes always require customary gibbets.

Evil is a shifting calculus, as Caesar's depredations are more excusable than Hitler's and Stalin's because the latter should have known better and unlike Caesar certainly betrayed the customs of their times. We cannot avoid affective judgements, and as we feel others pain, we also feel anger for obvious and avoidable depredations against reason. From the rudeness of a tailgating driver to the callousness of an authoritarian dictator, we can't help ourselves, for if dispassion was the measure of man, then society would be populated by sociopaths.

Freedom

Freedom, in its most basic sense, is the ability to choose a goal and pursue it with a minimum of encumbrances. To state an opinion, pursue an education, open a business, worship as you please, or just travel wherever you want represents basic rights that are enshrined in almost all democratic societies. Like an undammed river, the notion is that motivation will take its natural course once the obstacles are removed. As the metaphor goes, water moves downhill, but the direction the water takes is due to obstacles, not an innate sense of where it is going or should go.

In a free marketplace of goods and ideas, the removal of physical, economic, or social barriers is key to incentivizing people to create and produce. Yet *access* does *not* equate to incentive, but rather to the discrepancies imbedded *in*

access that may by turns induce inspiration or lassitude. This is lesson scarcely learned by economists and psychologists alike, or not even that.

'Free' societies trumpet our unfettered ability to move human and capital resources, all according to fixed timetables and without encumbrance. But whereas the economic pistons of supply and demand are determined with certainty, motivation is not. A reward, in the horizon, or at the tip of your nose, is only the barest predictor of behavior, and to assume that either is the case is a recipe not for utopia but for an authoritarian state. Authoritarian principles relish in certitude, and freedom, and the free access can be as deadening to incentive as when they are denied. Our freedom, and the incentive that comes from freedom, involves not the removal of obstacles, but in their creation and in their *timing*.

A river flows given a suitable inclination, with the force of gravity handling the rest. The directions it flows are difficult to predict, and unless foreordained by an outside force, will travel in unpredictable ways. The direction is immaterial, at least to an indifferent nature that is. But humans are not, so to speak, as inclined. We desire a more sensate and affective resolution, and that comes not from enticing ends, but enticing means as well. And the latter is ultimately not a matter of freedom, but of conscious design based on the true nature of man. A philosophy if you will that is ironically several thousand years old.

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Philosophy

In the ancient world, when knowledge was small, one could think big, and put physics, biology, and ethics under the same tent. After all, forces of nature were divinely inspired if not controlled, and the gods shared a human nature even if inspiration was not divine. Seeing was believing, and an earth placed square in the center of the heavenly firmament meant that the universe was designed and could be used for human purposes, and human nature was part of the heavenly scheme of things.

The question was, do humans have a built-in purpose, and in the largest scale, does the universe? The ancient Greeks thought they had the answer, and being a practical sort, envisioned pragmatic gods and a nature at once reasonable, useful, and geared to purposes and ends that dovetailed with the nature and aims of men.

To the Greeks, human inequalities and the prejudices that arise from them are rooted in misconceptions about the plasticity of their causes. From this perspective, human error is not inextricably wedded to human intransigence, and if applied effectively, reason could move people as well as mountains. In addition, emotion and reason are not at cross purposes, but mutually serve each other. Achieving that synthesis was the major challenge posed by philosophy.

The foundational principles of Greek philosophy underscored a confidence in human perfectibility or virtue. These principles are simple: that happiness is the exercise of human virtue, that affect should conform with reason, with human comity and collaboration as the preferred state of civilization, and that the universe had a purpose that was predicated on human values.

The virtuous life is identical with the happy life (that virtue is all that is needed to ensure happiness)

Virtue is competence born of reason, the ability to understand the world and how it works and how to act upon it. Reason is the guiding star rather than unyielding scripture, and is malleable by experience and affirmed by criticism. Happiness in turn is the eudaemonic result of a life well lived.

Emotions and desires depend directly on beliefs about what is valuable or desirable; they do not form a separate (non-rational) dimension of psychological life.

Emotions are the affective attributes of incentive, and are as intrinsic to behavior as color is to a coat of paint. Informed by reason, emotions empower behavior that meet individual and group interests which are intrinsically bound. Pure reason alone is not sufficient to impel behavior, and conforms with and is informed by affect.

Humans have an in-built natural inclination to benefit others

Virtue to the Greeks was not self-less altruism, of the self literally killing itself by kindness, with the reward of a higher position in a heavenly queue poised for rebirth or perhaps a position in the heavenly choir. Virtue was enlightened self-interest, or selfishness guided by reason. For humanity that meant understanding the virtues of collaboration, or the synergies that occur when humans work together. That doesn't mean that life escapes cruelties and pain, but that self-interest is furthered by the cultivation of mutual interests.

It may be said that if a chicken couldn't reason, it would be a meal, if could think and cipher, it could make a deal. Self-interest means consuming resources or developing them, but whether chickens or men, each are readily cast aside if thought as un-redeemably rotten. In Greek philosophy, it

was presumed that redemption was earned with reason, and in the faith that since mankind possessed perfectly reasonable minds, that no one was beyond redemption. Any thinking entity, once intelligence is recognized as mutual, is better off led, not dead. Indeed, only if reasoning was intractable and resistant or immune to correction would one want to ring their neck, like a chicken.

The Universe is Melioristic.[118]

The Greeks believed in a design and purpose in nature, and invented the western ideal of progress. That humans have a purpose and can engineer the universe to serve it finds voice in the work of the contemporary physicist Frank Tipler, who argues for a melioristic cosmos that is guided by human values.[119] But meaning precedes humanity, and is a requisite for life itself. Natural selection selects and preserves information, coded in our genes, that enables organisms to survive. Because the demands of the world are always changing, genetic variations are selected that are reflected in the changing morphologies or shapes of organisms that evolve over time. The ability to consciously model the world, and to react to what-if contingencies, or foresight, adds an additional capability to organisms to react to an uncertain world without having to physically engage with that world, or to be able to look before you leap. Organisms must be able to prepare for uncertainty, and they do this by seeking it, and it here that meaning is born. Meaning is the driving instinct for all life, regardless of complexity, and in its most rarefied confines, is the soul of philosophy.

Stoicism

A topic of major debate at this time was whether the natural universe embodied an in-built purpose or meaning or whether it

was simply the random outcome of natural laws or processes. The Stoics, following Plato and Aristotle, adopted this view. The Stoic belief in in-built purpose was connected with their view that all events are determined, and that the whole sequence of events embodies divine purpose or providence. As this point illustrates, the Stoics saw the branches of philosophy (in this case, ethics and physics) as interconnected and mutually supporting. Thus, their belief in divine providence belonged to the study of theology (which for them formed part of physics). But this belief also helped to provide a meaningful framework for ethics; while ethics in turn made sense of ideas (such as 'good') which underpinned the notion of providentialism and thus supported the principles of theology. As this point indicates, the Stoics saw philosophy as forming a highly unified and systematic body of knowledge. The ability to trace and understand connections between different ideas and between the branches of philosophy thus formed an important part of the study of Stoicism.[120] Christopher Gill

The preeminent importance of purpose or meaning is not a matter of chance or mere human conceit, but it an inherent aspect of the natural laws that evolved our universe and life itself. This interconnection between the inanimate and animate, of our physical and biological worlds, restores the catholic or universalist perspective of nature that was founded in Greek, and more specifically Stoic philosophy. Stoic philosophy, from its physics to its ethics, derives unsentimentally from the laws of nature, and virtue proceeds from human empathy based on understanding. It is prescriptive not in terms of what we do, but why we do. But with everyday questions come ultimate questions, and consilience, or the unity of all knowledge, means not just an accounting for the facts of existence, but for its ultimate direction or purpose. As we shall argue, the bittersweet fact

of existence is that all good things have their allotted time and place, and must eventually end.

The Ends of the Earth

"The great end of life is not knowledge, but action."

—Thomas Henry Huxley

In Isaac Asimov's classic 'Foundation' series of science fiction novels, an empire that spanned the galaxy was at the apex of its influence and power, but to one man its doom was imminent, a dire end that was not foreordained in the stars, but in the math. But as in all math problems, there can be multiple solutions that lead to better means if not better ends.

"*Psychohistory dealt not with man, but with man-masses. It was the science of mobs, mobs in their billions. It could forecast reactions to stimuli with something of the accuracy that a lesser science could bring to the forecast of a rebound of a billiard ball. The reaction of one man could be forecast by no known mathematics; the reaction of a billion is something else again."*[121]

"Using psychohistory, Seldon mathematically determined what he called The Seldon Plan—a plan to determine the right time and place to set up a new society, one that would replace the collapsing Galactic Empire by sheer force of social pressure, but over only a thousand-year time span, rather than the ten-to-thirty-thousand-year time span that would normally have been required, and thus reduce the human suffering from living in a time of barbarism.".[122]

The developmental trajectory of societies follows immutable laws derived from first principles of individual motivation, in Asimov's case the statistical motions of human groups, and in our case the core motivations of human individuals. Both have their separate predictions of humanity's epic fails, one in a conflagration envying

Rome's fall, and the other in whimper, and for both with the ascension of, as we shall consider, something or someone else.

The future is determined by a fundamental understanding of human nature and its laws. We fine tune our physical environments to meet the temperature, sustenance, shelter, and resistance to harm from all agents physical and biological. Psychological requirements are subtler, but no less real, and spin from evolutionary imperatives ages old. As we have argued, they can be as easily effected as changes in table settings.

Societies change not by evolution, but through *erudition*, or understanding the psychological dynamics that support not base narratives, but basic explanations. Truly free societies support criticism on all levels, from the technological to the psychological, and their political and social economies change with experience. Here again education is key, as an engaged electorate capable and incented to think critically is necessary for furthering and defining the aims of society.

The Ends of Civilization

The popular prognosticators of the future, from science fiction authors to the informed elite in the social sciences are most known not for what they get right, but what they get wrong, more often spectacularly wrong. Surrounding the hard and mostly accurate projections of the physical sciences that point to a technologically bright future are the social prognosticators who find that the ends of civilization are invariably led by technologies which literally end civilization.

One can blame the audience for the presumed nemesis of technology, as we have a penchant for dystopian thinking.

It is after all more dramatic and entertaining, albeit tinged with a depressive apprehension. Following Tolstoy's observation that all happy families are alike, but every unhappy family is unhappy in its own way, good outcomes are just not good drama, but great entertainment. Still, there is a numbing sameness even in our dystopias that belie their promise of unique drama.

On the other hand, physicists tend to possess an inbred optimism, for any accomplishment or technology if not against the laws of physics can made be true. However, the capabilities of technology does not mean that it is not inconvenient, impractical, disruptive, or expensive. So much for flying cars or prefab mansions the size of small islands, for the foreseeable future at least.

The changes that will occur are more unexpected and subtle and can be as deadly if not to humanity, than to the human spirit. Rather than the usual suspects of dystopias such as authoritarian states, pandemics, over population, evil AI, alien invasions and war, we should instead beware of our coming utopias: democratized states, under population, benign AI, world peace, and predictability.

The future prospect of a sane, just, and bounteous world past our mortality is a dimension not often considered as we tend to our immediate concerns of a fractious and seemingly disintegrating world. The irony is, as utopias go, even benign futures leads to inevitable endings, a parting that is a sweet sorrow, but a sorrow nonetheless, as humanity dwindles, science becomes complete, and intelligence of a different sort triumphs.

The Ends of Population

In their book, 'The Empty Planet',[123] John Ibbitson and Darrell Bricker concluded that world population will be sharply declining due to changing incentives. In a present day where children are hard to raise and harder to domicile, it does not profit women emotionally or financially to have more than one or two children, or any for that matter at all. And so they don't. How did the authors find this out? Besides the statistics they just asked women across cultures and continents.

Declining fertility has its issues, particularly with caring for an aging population. But the benefits are manifest. The risk of famine will disappear, affluence and individual autonomy will rise to new heights, and the environment will heal. All this is happening for a simple reason, namely rapidly evolving incentives. Children are not assets if a woman can find a good job in their stead and a lessening need for them to assist in the household or countryside, particularly if both are minimized in an urban environment that they will likely reside. And so the demographics tell the tale, with rapidly declining fertility rates in all societies, from the most urban to even the most rural.

The irony here is palpable, as the diminution of the race is one of personal choice, with faith in numbers replaced by incentives that make individual security, accomplishment, and comfort dependent upon our machines, not our children. The incentive for family and children become personal, not economic, as fewer children make for households more intimate and rewarding due to individual attention and care.

The End of Science

In John Horgan's 1996 book, 'The End of Science'[124] the age of scientific discovery will come to an end, but this had a precedent in ancient and medieval times, when all that could be known was known, with only the literal shaping of reality from art to engineering left for creative minds. Those declarations were premature then, but are not so in our present and near future. Horgan paints a dour future for scientific discovery, but one previous generations have seen before. This time however, he may be right.

First, all the big problems have been solved, or soon will be: there just aren't many more truly fundamental discoveries. Second, science is approaching its intrinsic limits, in that it is posing questions that it will never be able to answer. Lastly, science is running up against the law of diminishing returns, it takes more and more money and effort for facts that are progressively smaller and less interesting. What further deadens the incentive for inquiring minds is that our machines will further broaden what we know, confirm or disconfirm what we thought we knew, and take the credit, but none of the pride. A daunting and deadening prospect for future discoverers, but a dearth of future Einsteins won't preclude a bounty of future Mozarts who aren't seeking too many notes, but use quite well the one's they have, as creation is not just the novel discovery of novel facts, but of the novel arrangements *of* facts. And as befits the past, the spirit of discovery is replaced by the spirit of engineering, from space stations to space operas, and these tales can be literally streamed in novelty for countless generations to come.

A theory of everything, where science discovers all the regularities of nature, means that the syntax or language we use from the mathematical calculus to that which describes the neuro-biological calculus of human behavior is a finite

quality, or at least approaches a level of completion that makes further inquiry of vastly diminished importance. However, although syntax is limited, semantics is limitless, and a finite language can map to infinite worlds both real and virtual. Even nature has obliged us with hypothetical multiverses which comprise infinite branching realities.
Science won't be ending this year, and perhaps not even in a century, and although we can arrange the laws of nature in infinite ways, and create entirely new physics for entirely new worlds, science forever reborn may be possible, but is it meaningful? Like a tree falling unobserved in the forest, would a new scientific fact be heard if no one is listening? We listen and observe to what we deem important and forget or ignore the rest, and when observers are gone or diminished, science recedes, but with a keen observer, science is complete, who may restart the quest for knowledge for newly evolved observers with a big bang or two.

The Ends of Computing

"By the 2020's full-immersion virtual reality will be a vast playground of compelling environments and experiences. Initially VR will have certain benefits in terms of enabling communications with others in engaging ways over long distances and featuring a great variety of environments from which to choose. Although the environments will not be completely convincing at first, by the late 2020's they will be indistinguishable from real reality and will involve all of the senses, as well as neurological correlations of our emotions. As we enter the 2030's there won't be clear distinctions between human and machine, between real and virtual reality, or between work and play. - Ray Kurzweil[125]

Reality bites, and that is why reality, or at least the reality virtualized in human brains is the better deal. Whether we are taking a bite out of a sandwich or a mosquito is taking a bite out of us, reality has its unique pleasures which are leveraged off its unique pains. Virtual reality is attractive when we have not yet mastered how to make our mundane reality attractive, as prisoners have no option but to live in daydreams. Indeed, the attractions that make virtual reality so compelling can be easily replicated for real in a world where we can make up the drama of accomplishment for all manner of human experience upfront and personal.

Real reality means you have a hand on the power switch, but virtual reality means someone else does. Our concern is whether the incentives that impel our real selves are the same as those outside selves, from theological to computational phantasms that ultimately make up our fates.

For the computational side, being safe and sound is a simple matter of establishing the rules, and to address this issue one science writer of surpassing imagination was up to the task. To the great science fiction writer and popularizer of science Isaac Asimov, as a species of sentient life, machines had an obligation to humanity that was not as much second nature as second hand. In other words, another hand had to come in to play to tip the balance of its uncertain instincts to favor human interests and human masters. This was an obligation that was codified in the three laws of robotics,[126]

First Law A robot may not injure a human being or, through inaction, allow a human being to come to harm.

Second Law A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

Third Law A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

The robotics laws are not so much evolutionary as they are cautionary, as the evolutionary drivers of all life, from human to galactic, are invariably thought of for reasons of intent or disregard to be misanthropic. We tend to think of extra-terrestrial civilizations as adhering to codes of conduct that follow the standard tropes of how we think motivation must be, and are guided not by our future prospects but our historical failures. Thus, they are preoccupied with galactic colonization, marshalling scarce resources and power, with the result that they are constantly menacing and invading us in endless quests for our water, our women, or worse.

The idea that intelligent life needs statutory guardrails built by law and custom misses the point. Evolution mandates uncertainty, and the selection of physical and behavioral traits that can expect it, demand it, and adapt to it. Meliorism and the virtues of care and concern do not have to be mandated; they are baked into the laws of existence. Perhaps we have not found intelligent life because of how life must act when it acts intelligently, and through courtesy allows us to bask in our uncertainties.

Meliorism is inherent in all life, and uncertainty is the only thing that is consumed and is at the same time infinite and free. But is our world, so seemingly teetering constantly on a precipice, the best of all possible? Our alternative reality, or heaven of heavens is a fairly predictable place, where we bathe in sublime stasis. But is it? In an episode of the landmark television series of ironic tales, the 'Twilight Zone', a burglar is shot and killed, and his spirit is met by a jovial figure, who lets him realize his every desire, without

a doubt. Soon bored by the predictability of his pleasures, he asks his charge to go to the other place, being in agony with this heaven. To which the man responded laughing, "And what makes you think this is heaven?"

The Ends of Humanity

Understanding how plants grow can create the opportunity to cultivate a thousand flowers in bloom. Like an athlete in his prime entering the last minute of a game long settled, he can achieve great feats that resonate nowhere.

Society will end, not in a conflagration, or want, or through the diminishment of the natural world, but in a bountiful garden, like the original garden of old that will perhaps in the ending days be a paradise only for two. Minding them and its own mind will be AI of course, creating uncertainty in its own way, anew, with new human actors as real as reality can be, strutting the stage, full of sound and fury, and signifying something that will echo in its own way into eternity.

Essential Reading

Popular books, as this one aims to be, should flow naturally from the learned opinion of authors who generally know a whole lot more about their respective fields than the author who cites them. Although this author addresses the novel implications of their work, nonetheless one must not stray too far from one's tenuous perch on the shoulders of giants, as our argument is not to make a break from well researched opinions, but to demonstrate how it develops and validates them in new ways. This is important in order to provide background and perspective on the elements of theory and practice not addressed in this book, and to provide a critical reference and even counterpoint to my arguments, particularly if these arguments advance too far from what the data can support.

Learning Theory

Learning theories advanced in the 20th century with a rapidity that matched similar scientific revolutions in earlier centuries in physics, biology, and astronomy. The reason for the late maturity for the science of motivation or learning is technological, not inspirational, as the tools necessary to localize neural processes 'in situ' (where it happens) and to observe them 'in vivo' (how it happens) only grew in capability and precision in the last few decades. Although many neuroscientists have contributed to modern learning theory, the neuro-psychologist Dr. Kent Berridge of the University of Michigan stands out in both scholarship and focus to provide the basis of many of the arguments I have advanced in this book.

Although not the author of any popular or academic text on learning theory, Berridge is nonetheless an excellent essayist on the history of learning theory and the critical issues addressed by affective neuroscience, from emotion to addiction, as well as making major contributions to the understanding of the neural processes that underscore emotion, motivation, learning and reward.

Contemporaneous to Berridge's work on incentive motivation was the converging perspective of the bio-behaviorists John Donahoe and David Palmer, who utilized higher order 'adaptive neural net' mathematical models that were mapped to observable bio-behavioral processes. Their unified principle of reinforcement was based on the same discrepancy principles adopted by Berridge and reflected the same neuro-biological mechanisms as evidenced by dopaminergic systems. However, it is remarkable that the respective authors arrived at their similar perspective independently, and even without cross-citations.

Whereas Donahoe and Palmer's work is scholarly and not readily available to a lay audience, Kent Berridge brings to his published research and commentary a lucidity and economy of style that is easy to understand in many of his published articles. Nonetheless, he is perhaps a bit too matter of fact or modest for his unique contributions and their revolutionary (at least to this writer) implications. Fortunately, and unlike almost all of his peers in the neurosciences, all of his works are available for download on his website:

https://sites.lsa.umich.edu/berridge-lab/

Berridge's output is extensive, from overviews of topics such as emotion, addiction, and inventive to individual experiments on laboratory animals.

For the best short non-technical history of the development of learning theory from Thorndike to the present.

Berridge, K. (2001) Reward learning: reinforcement, incentives, and expectations. *The Psychology of Learning and Motivation*, 3, Academic Press, New York.

Below is an excellent description of emotion as well as an accounting of Wundt's influence, although Berridge left out the bi-polar dimension of strain and relaxation that figures greatly in analysis of stress. Berridge overall neglects this key element of Wundt's work, and also neglects any explanation of the origins and functionality of neuro-muscular tension or stress.

Berridge, K. C. (2019). A Liking Versus Wanting Perspective on Emotion and the Brain. The Oxford Handbook of Positive Emotion and Psychopathology, 184.

Berridge, K.C. Evolving concepts of emotion and motivation. *Frontiers in Psychology*, 9, 1647, 1-20, 2018.

Donahoe and Palmer's 1993 textbook 'Learning and Complex Behavior' represents the best and most thorough technical overview and case for a neurologically based radical behaviorism. The authors make the argument, seconded by this book, that complex behavioral phenomena are emergent outcomes of the cumulative action of relatively simple bio-behavioral processes. Although their work was handicapped by their neglect of the role of affect, they demonstrated convincingly how the processes of reinforcement, perception, language, thinking, and memory could be derived from rudimentary neurological processes. A good overview of their concept of the unified reinforcement principle is provided by their 1993 paper linked below.

https://www.scribd.com/document/452396505/10-Donahoe-Burgos-Palmer-1993-pdf

Skepticism

Explanations, not correlations count, and the emphasis on falsifiability is a counterweight to the inductivist traditions that have and continue to dominate the social sciences. Theories do not confirm prior observations, but make new ones that are in principle, subject to confirmation or test. This is the philosophy of the great philosopher of science Karl Popper, who is sorely absent in the confident musings of intellectual pundits today.

A good contemporary example of skeptical perspective on psychological research, from the behavioral to neuroscience, is John Horgan's 'The Undiscovered Mind'[127], for economics, Taleb's 'The Black Swan'[128] , and for physics, Deutsch's 'The Fabric of Reality'[129]. And as for the explanatory validity of this authors musings, only time and test will tell.

Endnotes

[1] Observations of the regularities of nature, even if seemingly comprehensive and complete, invariably lead to systems of derived rules or explanations that make testable predictions. The problematic application of these rules causes the scientist to revisit and enhance his observations so that his theory or explanation better fits reality. This conforms with the philosopher of science Karl Popper, who viewed science as starting with problems rather than with observations—*it is, indeed, precisely in the context of grappling with a problem that the scientist makes more useful observations in the first instance: his observations from experiment are selectively designed to test the extent to which a given theory functions as a satisfactory solution to a given problem.* Stanford Encyclopedia of Philosophy *https://plato.stanford.edu/index.html*

[2] Wikipedia Levels of Adequacy

[3] To attain *observational* adequacy, a bio-behavioral theory of incentive ultimately considers every behavioral and neurological nuance, variation, and change that impacts decision making, from the bio-chemical to the ethological. However, for the same theory to meet *explanatory* adequacy, although empirically incomplete, the marginal reduction in its predictive power is traded off for a greater degree of usability that can be understood and employed by experts and novices alike. Our book is an explanatory account of incentive, yet the physical sciences are rife with similar examples. For example, Newtonian equations map to physical events, and provide for the prediction of the movement of cannon balls and orbiting moons, and allow

us to conceive all manner of objects from speeding bullets to bullet trains. Nonetheless, Newtonian mechanics is not a complete description of reality and fails on the macroscopic (Einsteinian) and microscopic (quantum) levels. Our theory of incentive motivation is thus 'level adequate' or describes and manipulates the reality that we experience and engage, but does not fully describe reality, as truth, like the devil, ultimately resides in the details.

[4] The term 'affective neuroscience' was coined by the neuro-psychologist Jaak Panksepp, whose extensive research on affect and behavior was foundational to this nascent science. "*In his book Affective Neuroscience, Panksepp described how efficient learning may be conceptually achieved through the generation of subjectively experienced neuro-emotional states that provide simple internalized codes of biological value that correspond to major life priorities." (Wikipedia)*

Panksepp was also among the first to conclude that basic motivational principles or incentives emerge from simple bio-behavioral processes of ancient origin.

"It may be hard for us to accept that human strivings are ultimately driven by the welling up of ancient neurochemicals in primitive parts of the brain. This view does not easily fit into our concept of ourselves as moral and spiritual beings. Although the details of human hopes are surely beyond the imagination of other creatures, the evidence now clearly indicates that certain intrinsic aspirations of all mammalian minds, those of mice as well as men, are driven by the same ancient neuro-chemistries. These chemistries lead our companion creatures to set out energetically to investigate and explore their worlds, to seek available resources and make sense of the contingencies of their environments. These same systems give us the impulse to become actively engaged with the world and to extract meaning from our various circumstances." P.41

Panksepp, Jaak (1999) *Affective Neuroscience*. New York: Oxford

[5] Our philosophical stance in this book coheres with the linguists George Lakoff and Mark Johnson's concept of *embodied realism*, that incorporate sensorimotor aspects of experience, of affect as integral to cognition and not a separate entity apart from reason.

"From a biological perspective, it is eminently plausible that reason has grown out of the sensory and motor systems and that it still uses those systems or structures developed from them. This explains why we have the kinds of concepts we have and why our concepts have the properties they have. It explains why our spatial-relations concepts should be topological and orientational, and it explains why our system for structuring and reasoning about events of all kinds should have the structure of a motor control system.

…Philosophically, the embodiment of reason via the sensorimotor system is of great importance. It is a crucial part of the explanation of why it is possible for our concepts to fit so well with the way we function in the world. They fit so well because they have evolved from our sensorimotor systems, which have in turn evolved to allow us to function in our physical environment. It is the embodiment of mind that leads us to a philosophy of embodied realism. Our concepts cannot be a direct reflection of external mind-free reality because our sensorimotor systems play a crucial role in shaping them. On the other hand, it is the involvement of the sensorimotor system in the conceptual system that keeps the conceptual system very much in touch with the world."

Lakoff, George & Johnson, Mark (1990) *Philosophy in the Flesh: The embodied mind and its challenge to western thought*. New York: Basic Books

[6] Wikipedia

[7] This book proposes that the idiosyncrasies of behavior can be derived from first principles, namely an understanding from human neuroscience as to how incentive motivation works. Without this we are forced to rely on separate correlations between external observations and external events, with behavior acting in eccentric patterns like the planets in the night sky. In his critique of behavioral economics (or the study of how economic choices are determined by human psychology), the economist Jason Collins used just this analogy to describe how a lack of a deep and foundational understanding of how the world works can make the solar system seem positively deviant.

"So, I want to take you to a Wikipedia page that I first saw when someone tweeted that they had found "the best page on the internet". The "List of cognitive biases" was up to 165 entries on the day I took this snapshot, and it contains most of your behavioral science favorites … the availability heuristic, confirmation bias, the decoy effect – a favorite of marketers, the endowment effect and so on ….

But this page, to me, points to what I see as a fundamental problem with behavioral economics.

"Let me draw an analogy with the history of astronomy. In 1500, the dominant model of the universe involved the sun, planets and stars orbiting around the earth. Since that wasn't what was actually happening, there was a huge list of deviations from this model. We have the Venus effect, where Venus appears in the evening and morning and never crosses the night sky. We have the Jupiter bias, where it moves across the night sky, but then suddenly starts going the other way. Putting all the biases in the orbits of the planets and sun together, we end up with a picture of the orbits that looks something like this picture – epicycles on epicycles. But instead of this model of biases, deviations and epicycles, what about an alternative model?

The earth and the planets orbit the sun.

Copernicus, of course, it's not quite as simple as this picture – the orbits of the planets around the sun are elliptical, not circular. But, essentially, by adopting this new model of how the solar system worked, a large collection of "biases" was able to become a coherent theory. Behavioral economics has some similarities to the state of astronomy in 1500 – it is still at the collection of deviation stage. There aren't 165 human biases. There are 165 deviations from the wrong model. So what is this unifying theory? I suggest the first place to look is evolutionary biology. Human minds are the product of evolution, shaped by millions of years of natural selection."
https://evonomics.com/please-not-another-bias-the-problem-with-behavioral-economics/

[8] Embodied cognition - Wikipedia

[9] Why Cognitive linguistics requires embodied realism
https://escholarship.org/uc/item/2pv0z6cm

[10] *"The problem with classical disembodied scientific realism is that it takes two intertwined and inseparable dimensions of all experience-the awareness of the experiencing organism and the stable entities and structures it encounters, and erects them as separate and distinct entities called subjects and objects. What disembodied realism misses is that, as embodied imaginative creatures, we* ***never*** *were separated from reality in the first place. What has always made science possible is our embodiments, not our transcendence of it, and our imagination, not our avoidance of it."*
Lakoff, George & Johnson, Mark (1990) *Philosophy in the Flesh: The embodied mind and its challenge to western thought*. New York: Basic Books

[11] It must be added that no harm was done to the dogs, who experienced no discomfort and survived quite well during and after the procedure. Indeed, Pavlov was always concerned with the welfare of his laboratory animals and refused an extra allocation of food during the Russian revolution until his dogs were equally accommodated.

Bolles, Robert C.. (1975) *Learning Theory*, New York: Holt, Rinehart, and Winston

[12] The operational distinction between respondent and operant conditioning has not withstood experimental test. Characteristic of this was the work of the experimental psychologist Neal Miller. Miller, Leo DeCara, and their colleagues carried out a series of animal experiments in the 1960's, demonstrating the operant conditioning of a variety of internal autonomically regulated physiologic processes, including blood pressure, cardiac function, and intestinal activity.

Miller, N. E. (1969). Learning of visceral and glandular responses. *Science*, *163*, 434-445.

Miller, N. E. (1978). Biofeedback and visceral learning. *Annual review of psychology*, *29*, 373-404.

Miller, N. E., & DiCara, L. (1967). Instrumental learning of heart rate changes in curarized rats: Shaping and specificity to discriminative stimulus. *Journal of Comparative and Physiological Psychology*, *63*, 12-19.

Miller, N. E., & Dworkin, B. (1974). Visceral learning: Recent difficulties with curarized rats and significant problems for human research. In P. A. Obrist; A. H. Black, J. Brener, & L. V. DiCara (Ed.), *Cardiovascular psychophysiology* (pp. 312-331). NY: Aldine.

[13] Donahoe, John W. & Palmer, David (1993) *Learning and Complex Behavior.* Boston: Allyn and Bacon pp7

[14] *"From the perspective of a unified reinforcement principle, classical and operant conditioning are not two different 'kinds' of learning, but two procedures that differ with respect to the environmental and behavioral events that are reliably present when selection occurs"*
Donahoe, John W., Palmer, David C. and Burgos, Jose E. (1997) The S-R issue: Its status in behavior analysis and in Donahoe and Palmer's Learning and Complex Behavior. *Journal of the Experimental Analysis of Behavior*, 67, 193-211.
[15] Donahoe, John W., Palmer, David C. and Burgos, Jose E. (1993) A
Selectionist approach to reinforcement. *Journal of the Experimental*
Analysis of Behavior, (60), 17-40

[16] Guerra, L. and Silva, M. 2010 Learning processes and the neural analysis of conditioning *Psychology & Neuroscience*, 2010, 3, 2, 195 - 208

[17] Ibid
[18] Berridge, K. (2018) Evolving Concepts of Emotion and Motivation. *Frontiers in Psychology*. 9:1647.
[19] Morra, J. T (2007) The neural substrate of disappointment revealed. *Journal of Neuroscience*, 27(40), 10647-10648

[20] Fiorillo, C., Tobler, P, & Schultz, W. (2003) Discrete coding of reward probability and uncertainty by dopamine neurons. *Science*, 299:1898-1902
[21] Berridge, K. (2007) The debate over dopamine's role in reward: the case for incentive salience. *Psychopharmacology*, **191**, 391-431

[22] Knutson, B., & Greer, S. M. (2008). Anticipatory affect: neural correlates and consequences for choice. *Philosophical*

transactions of the Royal Society of London. Series B, Biological sciences, 363(1511), 3771–3786

[23] Mohebi A, Pettibone JR, Hamid AA, Wong JT, Vinson LT, Patriarchi T, Tian L, Kennedy RT, Berke JD. (2019) Dissociable dopamine dynamics for learning and motivation. *Nature*. 570(7759):65-70.

[24] Berridge, K. (2018) Evolving Concepts of Emotion and Motivation. *Frontiers in Psychology*. 9:1647.

[25] This conception of drive as merely an artifact of an organism's sensitization to a stimulus event (food, drink) is also independently confirmed in Donahoe and Palmer's contemporaneous definition of reward which is based the neurologically grounded principles of neural networks. "*In our formulation, deprivation may affect behavior in several ways. For one, by depriving an organism of contact with a stimulus, that stimulus typically becomes a more vigorous elicitor of behavior. As such, the stimulus is able to function as a more effective reinforcer because its presentation evokes a larger behavioral discrepancy. Further, discriminative and occasion setting functions of deprivation, and motivating operations in general, may be readily implemented in neural networks. A discriminative function is enabled to the extent that the motivating operation differentially activates a range of units within a network, a motivating function is enabled to the extent that the motivating operation non-differentially activates a range of units within the network. In either case, the activation levels of units within the network are changed, thereby changing which connections are eligible for modification by the reinforcer. Through both means, the motivating operation may have a pervasive effect on behavior and on neural networks intended to simulate behavior.*" Donahoe, J.W., Palmer, D.C., and Burgos, J. (1997) The Unit

of Selection. What do reinforcers reinforce? *Journal of the Experimental Analysis of Behavior*, 67, 259-273

[26] Stewart, J. (1984) Reinstatement of heroin and cocaine self-administration behavior in the rat by intracerebral application of morphine in the ventral tegmental area. *Pharmacology Biochemical Behavior*, 20, 917-923

[27] Matthews, R.T. & German, D.C. (1984) Electrophysiological evidence for excitation of rat VTA dopamine neurons by morphine. *Neuroscience*, 11, 617-625

[28] Cook, C.D., Rodefer, J.S., and Picker, M.J. (1999) Selective attenuation of the antinociceptive effects of mu opioids by the putative dopamine D3 agonist 7-OH-DPAT. *Psychopharmacology*, 144: 239-247.

[29] Colasanti, A., Searle, G., et al. (2012) Endogenous opioid release in the human brain induced by acute amphetamine administration. *Journal of Biopsychology*, 72, 371-377

[30] Stefano, G. (1982) Comparative aspects of opioid-dopamine interaction. *Cellular and Molecular Neurobiology*, 2(3), 167-178

[31] It is well known that dopamine can enhance opioid activity in animals, but a similar finding has proven elusive for humans by virtue of the fact that direct observation of dopaminergic and opioid interactions in human beings is practically and ethically difficult. However, this does not preclude self-reports of individuals who can put in rank preference identical pleasurable stimuli (sucrose solutions), yet have greater pleasure attributed to similar stimuli when concurrently associated with dissimilar positive reward uncertainty for non-sensate stimuli. In other words, sensory experiences like eating popcorn are heightened when we are watching an exciting movie and dulled if we were watching paint dry, thus explaining the favor we give to

taking our pleasures concurrently with behavior that has high reward uncertainty.

If normative (i.e. what should happen) rather than abstract (i.e. how it should happen) expectancies are replaced in this equation, then we have a *placebo* effect. In essence, a placebo effect is a specific interpretation of opioid-dopamine interactions that attributes analgesic, pleasurable and other positive affect to conscious or non-conscious expectancies of pain relief or enhanced pleasure. This has been experimentally contested by Amanzioa and colleagues (link below), but also does not make sense empirically, as precursor or concurrent expectancies of novel outcomes may be *related* to the goal (expectation that the meal will be delicious) or *unrelated* to the goal (watching an exciting movie while eating a meal) and still have the same effect. This leads to the conclusion that not normative but *abstract* act-outcome expectancies or discrepancies that induce dopamine activity can modulate *ongoing* opioid activity due to food, drink, sex, rest or other stimuli.

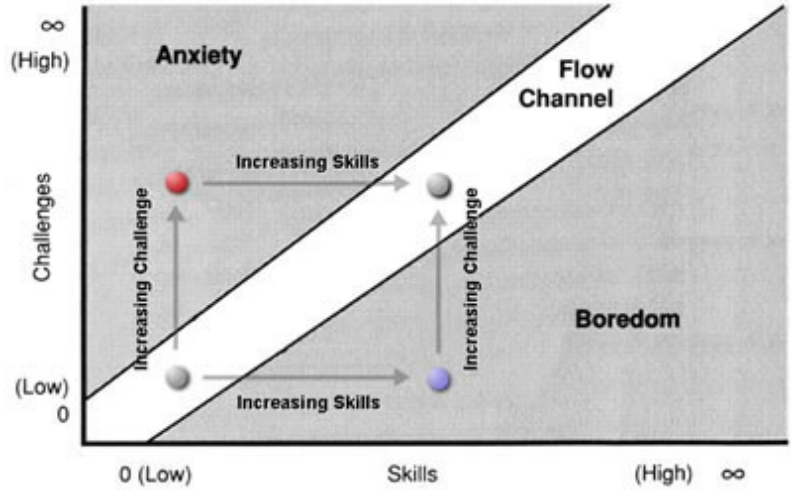
Rauwolf P, Millard SK, Wong N, Witt A, Davies TJ, Cahill AM, Madden GJ, Parkinson JA, Rogers RD. (2021) "Just not knowing" can make life sweeter (and saltier): Reward uncertainty alters the sensory experience and consumption of palatable food and drinks. *Journal Experimental Psychology General,* Epub ahead of print..

Amanzioa, M , Polloa, A , Maggib, G, & Benedettia, F. (2001) Response variability to analgesics: a role for non-specific activation of endogenous opioids, *Pain*, 90, 201-215

[32] McCubbin, J. A., Wilson, J. F., Bruehl, S., Ibarra, P., Carlson, C. R., Norton, J. A., & Colclough, G. W. (1996). Relaxation training and opioid inhibition of blood pressure response to stress. *Journal of Consulting and Clinical Psychology*, 64(3), 593-601.

[33] The flow experience as a distinctive emotional state is more a creature of semantics than reality. The uncertain definition of flow is a cardinal example of Voltaire's maxim that to be understandable, one must first define one's terms. Flow was coined by the psychologist Mihalyi Csikszentmihalyi to describe the unique emotional state that parallels one's complete 'immersion' in a task. As described by the psychologist Daniel Goleman, "*Flow is completely focused motivation. It is a single-minded immersion and represents perhaps the ultimate in harnessing the emotions in the service of performing and learning. In flow, the emotions are not just contained and channeled, but are energized and aligned with the task at hand. To be caught in the ennui of depression or the agitation of anxiety is to be barred from flow. The hallmark of flow is a feeling of spontaneous joy, even rapture, while performing a task*."

These descriptions are of course metaphorical representations of the experience of flow, and describe what flow is like rather than what it is. Because these 'dependent' measures of flow have no empirical referent (What is the neurological equivalent of spontaneous joy for instance?), one is left with the independent or antecedent variables of demand and skill that elicit flow, which thankfully *can* be empirically defined. What is unique about these variables is that they not only map to flow experiences, but also other emotional experiences such as anxiety and boredom. Thus, Csikszentmihalyi's model does not just represent flow, but a wide range of emotional experiences. The question is, although emotion maps to demand and skill, can demand or skill be manipulated *in the moment* to elicit flow, or for that matter, any other emotion?



The Flow Channel

On the surface, the graphical representation of the flow channel is simple to understand. Just plot your moment-to-moment challenge against your moment to moment skill, and voila, you can predict what your emotions are going to be. For any task, the problem is that although demand moves up or down dependent upon the exigencies of the moment, skill should be relatively stable during or *within* the performance, and only change, and for the most part gradually *between* performances. Thus, one may accomplish a task that from moment to moment varies in demand, but the skills brought to that task are the same *regardless* of demand. What this means is that for any one-performance set, skill is not a variable, but a constant. That is, one cannot adjust skill against demand during performance because skill can only change negligibly *during* performance, or in other words does not move. Thus, for performance that requires any skill set, the only variable that can be manipulated *is* demand. For moment-to-moment behavior the adjustable variable that elicits flow is demand and

demand alone. But that leaves us with figuring out what demand exactly is.

A demand may be defined as simple response-outcome contingency. Thus, if you do X, Y will occur or not occur. It is thus inferred that demand entails a fully predictable means-end relationship or expectancy. But the inference that the act-outcome expectancy is always fully predictable is not true. Although a response-outcome is fully predictable when skill overmatches demand, as demand rises to match and surpass skill, uncertainty in the prediction of a performance outcome also rises. At first, the uncertainty is positive, and reaches its highest level when a skill matches the level of demand. This represents a 'touch and go' experience wherein every move most likely will result in a positive outcome in a calm or non-stressed state. It is here that many individuals report euphoric flow like states. Passing that, the moment-to-moment uncertainty of a bad outcome increases, along with a corresponding rise in tension and anxiety.

Momentary positive uncertainty as a logical function of the moment-to-moment variance occurring when demand matches skill does not translate into a predictor for flow, and is ignored in Csikszentmihalyi's model because uncertainty by implication *does not elicit affect*. Rather, affect is imputed to metaphorical concepts of immersion, involvement, and focused attention that are not grounded to any specific neurological processes. However, the fact that act-outcome discrepancy in relaxed states *alone* has been correlated with specific neuro-chemical changes in the brain that map to euphoric, involved, timeless, or immersive states, namely the co-activation of dopamine and opioid systems due to continuous positive act/outcome discrepancy and relaxation, narrows the cause of flow to

abstract elements of perception rather than metaphorical aspects of performance. These abstract perceptual elements denote information and can easily be defined and be reliably mapped to behavior.

A final perceptual aspect of demand that correlates with the elicitation of dopamine is the importance of the result or goal of behavior. Specifically, dopaminergic systems are activated by the in tandem perception of discrepancy and the predicted utility or value of result of a response contingency. The flow model maps behavior to demand and skill, but not only is skill fixed, so is the importance of the goal state that predicates demand. However, the relative importance of the goal state correlates with the intensity of affect. For example, representing a task that matches his skills, a rock climber calmly ascending a difficult cliff would be euphoric if the momentary result was high, namely avoiding a fatal fall, but would be far less so if he was attached to a tether, and would suffer only an injury to his pride is he were to slip. Finally, the flow experience correlates also with a state of relaxation and the concomitant activation of opioid systems along with a dopamine induced arousal state that together impart a feeling of euphoria, which would also be predicted as choices in flow are singular and clear and therefore avoid perseverative cognition. It is the sense of relaxation induced pleasure and a feeling of attentive arousal that constitutes the flow experience.

The flow experience is not an explanatory model because it does not derive from a neurologically grounded explanation. Secondly, it is not even a very good *descriptive* model because it imputes a moment-to-moment variability in skill within a performance set that is not characteristic of *any* single performance, and because it ignores other

correlations between moment-to-moment act-outcome discrepancy (or risk), resting states, and affect that are well demonstrated in neurological explanations of incentive motivation. For example, dopaminergic activity may be elicited because of the positive uncertainty of the results of behavior that may occur from moment to moment (the touch and go quality of demand/skill equivalence) or perceived virtually in the future (the perception of branching uncertain and positive outcomes, or positive meaning). Dopamine is enhanced further through its synergistic relationship with relaxation induced opioid activity. Thus, a rock climber can achieve high positive affect through the demand/skill match as he riskily but calmly climbs a mountain, or he can be equally affected by taking a safe, straight and narrow course, motivated by the arousing likelihood of fame and fortune laying at the end of the trail.

Ultimately, the flow experience purports to explain a key facet of incentive motivation through an inductive approach that misrepresents the dependent (skill) and ignores the independent variables (discrepancy) that truly map to the affective and motivational experience that is flow. In other words, as a creature of metaphor flow is good literature, but not good science because it eschews the explanatory essence *of* science. Nonetheless, as literature can speak of hidden and unrevealed truths, the flow experience emerges from affective neuroscience, with the entailments regarding meaning and human virtue and happiness conforming with Csikszentmihalyi's own research and prescriptions, which is no small feat indeed.

[34] Incentives may be delivered by a small social group that has interests not shared by other larger social communities, however this does not hinder the easy generalization that

privately rewarded interests have a larger and more receptive audience than they actually do. This is particularly the case with academic literature, as the following observation attests.

"When I read academic literature, all too often by paragraph three I'm lost in a morass of quantitative analysis that is far beyond not only my abilities but those of almost every businessperson I've ever met. In my view, the authors devote far too much of their time conducting research and writing about it in articles that only their peers understand and too little time actually teaching. As a result, their students are getting progressively less for their money, a guarantee of future serious trouble for higher education.

... A couple of years ago, a valued faculty member who was responsible for a prolific output of financial research at a well-known business school resigned. This caused great distress within the college, as the administration feared that the school's rankings would suffer because it would no longer be associated with his scholarship. But while he was the school's most successful scholar, he certainly didn't teach anything related to his research. How practical was that research anyway? I've worked in the financial area for 50 years and I didn't have a clue as to what his most recent articles were about -- and nor did various business colleagues to whom I showed them. If we couldn't decipher his writings, for whom were they intended? My answer: The community of scholars who write for one another but not for their students and certainly not for business executives who are interested in practical ideas that might actually work" Larry Zicklin, Professor at New York University's Stern School of Business "

[34] Our explanation of perseverative cognition generally conforms with the 'perseverative cognition hypothesis', that holds that cognitive perseveration is the main constituent of stress. However, this hypothesis does not

provide an *explanation* of how cognitive perseveration signals tension and stress, nor does it describe the neurological correlates of neuromuscular tension and its opposite of rest. Because it is bereft of explanation, it cannot be used to explain corollary states of rest, meditation, peak experiences, and the like which we derive directly from the explanatory models to follow in this book.

Per Wikipedia, "*The 'perseverative cognition hypothesis' holds that stressful events cannot affect people's health, unless they think repetitively or continuously (that is, 'perseverate cognitively') about these stressful events. Stressful events themselves are often too short, as are the physiological responses to them. Therefore, the physiological responses during these stressors are unlikely to cause bodily harm. More importantly, many stressful events are merely worried about, or feared in the future, while they often do not happen or do not have the feared consequences. Nevertheless, the body reacts with prolonged physiological responses to continuous thoughts (perseverative cognition) about these stressors. Therefore, it is the perseverative cognition, and not the stressors that can eventually lead to disease. In scientific terms, it is said that perseverative cognition is a mediator of the detrimental effects of stress on one's health. Since its publication scientific evidence for this hypothesis has been accumulating.*"
Brosschot JF, Gerin W, Thayer JF. The perseverative cognition hypothesis: a review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research*. 2006 Feb;60(2):113-24.

[35] That incentives are relative and not absolute represent the long-established concept of the 'hedonic treadmill', where negative and positive contrast provides a constantly changing set point for happiness that is independent of the absolute satisfaction of basic needs.

"Through adaptation level effects, we incorporate our previous rewards into our current status quo, they become in effect, invisible. Our status quo, which incorporates our previous successes, becomes a new 'zero point'. This incorporation becomes enhanced when we evaluate our social status, because it involves a comparison with others, and those others with whom we have most contact tend to have roughly the same status that we do. Thus the reward of social status comes from its enhancement rather than experiencing it."

Brickman, P., & Campbell, D. T. (1971). Hedonic relativism and planning the good society. In M. H. Appley (Ed.), *Adaptation-level theory* (pp. 287-305). New York: Academic Press.

[36] The formal explanation for stress is quite complex, yet derives from a simple cause, namely muscular tension. It follows that the control of stress is dependent upon understanding not only tension, but its antecedent causes, which we argue mandates an understanding of how tension is learned.

*First, **the skeletal muscles contract** and the hypothalamus, a small neural center in the brain, reacts. The hypothalamus, among other organs, influences the autonomic nervous system, which involves involuntarily activities of bodily organs. It also mediates activity in the pituitary gland, which releases hormones into the bloodstream. Under stress, as the muscles tense, breathing becomes faster and deeper. The heartbeat quickens. Some blood vessels constrict, raising the blood pressure and almost closing the vessels right under the skin. The throat muscles and those in the nostril force these passages wide open. The stomach and intestines temporarily halt digestion. Perspiration increases, and secretion of mucous and saliva decreases. The pupils of the eye dilate involuntarily. At the same time the adrenal glands release two hormones, epinephrine and norepinephrine, which effect*

circulation, elevating heartbeat and blood pressure. These hormones signal the spleen to release more red blood corpuscles. They enable the blood to clot more quickly and encourage the bone marrow to produce more white corpuscles. They also increase the amount of fat and sugar in the blood. While these events are occurring, the pituitary gland secretes two more hormones, abbreviated TSH and ACTH, TSH and ACTH increase the rate at which the body produces energy which reinforces the signals sent to the adrenal glands through the autonomic nervous system. ACTH also causes the adrenals to release about 30 other stress related hormones43. -Source: International Stress Management Association (www.isma-usa.org)

[37] Besides being painful, sustained covert neuro-muscular activation causes major changes in the autonomic nervous system, or the stress response. Sympathetic autonomic arousal is elicited through the sustained contraction of high threshold motor units of the striated musculature, as occurs during running or weight training. But arousal may also be mediated by the sustained contraction of small low threshold motor units of the striated musculature and can be measured directly through EMG (electromyogram) or through indirect measures of autonomic arousal (e.g., skin conductance response or SCR; galvanic skin response or GSR) elicited by tension induced arousal. Physiologically, the neural pathways that detail how muscular tension instigates autonomic arousal have been well established. (1) Through a bi-directional connection between the reticular arousal system and muscle efferents, a dramatic decrease or increase in muscle activity throughout the body can respectively stimulate decreases or increases in sympathetic arousal. Critical to the reduction of sympathetic arousal is the elicitation of endogenous opioids through neuro-muscular inactivity or rest that not only diminishes stress-

induced neuroendocrine and autonomic responses, but also stimulate these effector systems in the non-stressed state. (2) In addition, tonic or sustained opioid activity down regulates opioid receptors, thus reducing the palatability of and craving for other substances (e.g., food or alcohol). (3) In other words, relaxation or resting not only counteracts the deleterious effects of sympathetic arousal but is subjectively experienced as a state of mild euphoria or pleasure due to the concomitant activity of opioid systems.

This striated muscle position hypothesis holds that the critical controlling event for autonomic arousal is covert neuro-muscular activity, and that rapid striated muscular activity can "mediate and thereby control what has been called autonomic, cardiovascular, and electroencephalographic conditioning." (4)

1.Malmo, R. B. (1975) *On emotions, needs, and our archaic brain*. New York: Holt, Reinhart, and Winston

1.Jacobson, E. (1970) *Modern treatment of tense patients*. Springfield, Il: Charles C. Thomas.

1.Gellhorn, E. & Kiely, W. F. (1972) Mystical states of consciousness: Neurophysiological and clinical aspects. *Journal of Nervous and Mental Disease*, 154, 399-405

1.Gellhorn, E. (1967) *Principles of autonomic-somatic integration*. Minneapolis: University of Minnesota Press

2.Drolet, G., Dumont, E.C., Gosselin, I., Kinkead, R., LaForest, S., Trottier, J. (2001) Role of endogenous opioid system in the regulation of the stress response. *Progress in neuro-psychopharmacology & biological psychiatry*, 25(4), 729-741

3.Mercer, M. E. & Holder, M. D. (1997) Food cravings, endogenous opioid peptides, and food intake: A Review. *Appetite*, 29, 325-352

4.McGuigan, F. J. (1993) *Biological Psychology: A Cybernetic Science*. New York: Prentice Hall

[38] Although tension or anxiety is a learned or conditioned response, it can also be an element of an unconditioned response to actual danger, or the 'flight or fight' response. The flight/fight fleeing system (FFFS) is activated by situations that entail imminent threat. In the popular literature of stress, the FFFS is commonly invoked for autonomic arousal occurring across all threatening and non-threatening situations. However, for distant threats (e.g. a spider approaching from a great distance away as compared to a spider an inch from your nose), or for non-threatening choice/choice conflicts (e.g., distractive conflicts), the FFFS is not activated. Thus, covert neuro-muscular activity in these situations cannot be attributed to instinctive flight/fight neural mechanisms, but to cortical activity, therefore implicating learning processes.
Berkman, E. T., Leiberman, M.D., & Gable, S.L. (2009) BIS, BAS, and response conflict: Testing predictions of the revised reinforcement sensitivity theory. *Personality and Individual Differences*, 46(5-6), 586-591

[39] Following Dollard and Miller, anxiety is induced by irreconcilable choices, but apart from its uncertain status as a 'drive', its cognitive precursors are undeniable, and goes back to Aesops's time. In the fable of Buridan's ass, a donkey that is equally hungry and thirsty is put between a bucket of water and a bale of hay. Not being able to decide, it starved to death. Fortunately, we are not born to be so dumb, but that doesn't mean our emotions won't second guess our rationality. Indeed, we encounter irreconcilable choices almost constantly during the day, and our feelings let us know about it. These choices occur when we must make decisions between alternatives that are near

equivalent in value, with the choice of one resulting in the postponement or loss of another. Irreconcilable choices can occur between rational choices, affective choices, or mixtures of the two. Thus we can be stuck at a literal fork of a road with one or the other being fifty percent likely to be the correct path to the destination, or be at proverbial fork in the road with one choice leading to an affective outcome (a piece of pie) versus the other leading to a rational one (staying on a diet). Finally, either fork may lead to different affective outcomes, such as an exciting video game with one choice and another equally interesting game for the other.

Whereas nature abhors a vacuum, human nature abhors the vacuum of indecision. For the indecisions that populate our working day, there is rarely a threatening event that would cause us to take flight or fight or be fearful, and they certainly aren't demanding in the sense of a pending deadline at work. They can be major or minor decisions but and can be occasional (e.g. frustration) or persistent (e.g. worry), and that is the key. They cannot be ignored, and they cannot be acted upon either, and since thinking is of little use in resolving them, your postural muscles contract to expedite your thinking for you, and force you to make a choice or avoid the situation. So why do postural muscles contract to begin with when you are posed with dilemmas? It is because they *hurt*. But what is the purpose of pain? Simple. Pain signals the problem and its obvious remedy, namely avoidance. Think about it. We don't put our hands on hot cooking pots, roaring fires, or hornet's nests because these things will hurt, and if we didn't have a sense of pain to warn us when we touch hot things, then instead of being able to make toast, we would *be* toast. Pain makes a faster case for action than deliberation, and our minds oblige our need to survive by forcing us to make a choice or avoid the

situation. This avoidance can be physical or mental, as we can walk away from the situation or just avoid thinking about it. In general, you don't want to think about events that cause pain, and if pain makes your decision making speedier and more useful or else impels you to escape, it has survival value and is thus easily learned. Tension is not an unconditioned response to a bad outcome, but a *conditioned* or learned response to indecision, and disappears when decisions cannot be made. Marr, A. J. (2006) Relaxation and Muscular Tension: A Bio-behavioristic Explanation, *International Journal of Stress Management*, 13(2), 131-153

[40] Brosschot JF, Verkuil B, Thayer JF. (2010) Conscious and unconscious perseverative cognition: is a large part of prolonged physiological activity due to unconscious stress? *Journal of Psychosomatic Research*, Oct; 69(4):407-16

[41] Lundberg, U. (1999) Stress Responses in Low-Status Jobs and Their Relationship to Health Risks: Musculoskeletal Disorders. *Annals of the New York Academy of Sciences,* 896, 162-172.

[42] Berridge, K. (2001) Reward learning: reinforcement, incentives, and expectations. *The Psychology of Learning and Motivation*, 3, Academic Press, New York.

[43] Lundberg, U. (1999) Stress Responses in Low-Status Jobs and Their Relationship to Health Risks: Musculoskeletal Disorders. *Annals of the New York Academy of Sciences,* 896, 162-172.

[43] Hagg, G. (1991) Static Workloads and occupational myalgia- a new explanation model. In P. A. Anderson, D. J. Hobart, and J. V. Danhoff (Eds.). *Electromyographical Kinesiology* (pp. 141-144). Elsevier Science Publishers, P. V.

[44] Marr, A. J. (2006) Relaxation and Muscular Tension: A Bio-behavioristic Explanation, *International Journal of Stress Management*, 13(2), 131-153

[45] Berridge, K. (2001) Reward learning: reinforcement, incentives, and expectations. *The Psychology of Learning and Motivation*, 3, Academic Press, New York. (this is duplicate, put different source here

[46] Lundberg, U. (1999) Stress Responses in Low-Status Jobs and Their Relationship to Health Risks: Musculoskeletal Disorders. *Annals of the New York Academy of Sciences,* 896, 162-172.

[47] Hagg, G. (1991) Static Workloads and occupational myalgia- a new explanation model. In P. A. Anderson, D. J. Hobart, and J. V. Danhoff (Eds.). *Electromyographical Kinesiology* (pp. 141-144). Elsevier Science Publishers, P. V.

[48] Wursted, M., Eken, T., & Westgaard, R. (1996) Activity of single motor units in attention demanding tasks: firing pattern in the human trapezius muscle. *European Journal of Applied Physiology*, 72, 323-329

[49] Wursted, M., Bjorklund, R., & Westgaard, R. (1991) Shoulder muscle tension induced by two VDU-based tasks of different complexity. *Ergonomics*, 23, 1033-1046

[50] Lundberg, U., Forsman, M., Zachau, G., Eklo F., M., Palmerud, G., Melin, B., & Kadefors, R. (2002). Effects of experimentally induced mental and physical stress on trapezius motor unit recruitment. *Work & Stress*, 16, 166-170

[51] McEwen, B. S. (1998) Stress, adaptation, and disease: allostasis and allostatic load. *New England Journal of Medicine*, 338, 171-179

[52] McGuigan, F. J. & Lehrer, P. (1993) Progressive Relaxation, Origins, Principles, and Clinical Applications. In Paul M. Lehrer (Ed.). *Principles and Practice of Stress Management*, 2nd ed. Guilford Press

[53] Berridge, K & Winkielman, P. (2003) What is an unconscious emotion, the case for unconscious liking. *Cognition and Emotion*, 17 (2), 181-211

[54] It must be noted that this conceptualization of emotion leaves out the exteroceptive or stimulus events that elicit affect that are not elicited by information, as we do not categorize being miserable on a hot, cold, or rainy day as being emotional, let alone attribute emotion to recoiling in pain with a stubbed toe!

[55] This is called a 'within group' design, where objects or organisms are studied individually, and is characteristic of much of the hard sciences, such as physics, anatomy, and neuroscience, where intermediary events linking cause to effect are easily observed. In contrast to the within group model are 'between group' designs, that compare groups of individuals who are subject to different experimental interventions (e.g., vaccine trials between separate groups that separately receive a vaccine and a placebo). Between group designs are most common in the social sciences, which correlate the responses of different groups who receive different treatment regimens. Between group designs are used when the physical processes that are intermediary between cause and effect (e.g., taking an aspirin and feeling better) are difficult to ascertain because of a confluence of intervening variables, such as the health and pre-existing conditions of individuals that may modulate the effectiveness of a treatment. So given this daunting complexity, the relative benefits of treatments are summarized *statistically*, rather than ascertained *causally*, and are useful in making general rather than specific predictions. This of course means that the validity of results are dependent upon the relative bias found in the statistics involved, rather than the observations themselves, the latter

being much easier to validate. These are problems that continually beset the social sciences, which use statistics to provide just about anything.

[56] Wundt, W. (1902) *Outlines of Psychology*. New York: Stanford

[57] Knutson, B. and Greer S.M Anticipatory affect neural correlates and consequences of for choice (2008) Philosophical Transactions of the Royal Society of London Biological Science, 12; 363(1511): 3771–3786.

[58] Berridge, K., Aldridge, J. (2008) Decision Utility, the brain, and pursuit of hedonic goals, *Social Cognition*, 26, 621-646

[59] Barrett L. F., Russell J. (1998) Independence and bipolarity in the structure of current affect. *Journal of Personality and Social Psychology*, 74, 967–984

[60] Berridge, K. (2007) The debate over dopamine's role in reward: the case for incentive salience. *Psychopharmacology*, 191, 391-431

[61] Fiorillo, C., Tobler, P, & Schultz, W. (2003) Discrete coding of reward probability and uncertainty by dopamine neurons. *Science*, 299:1898-1902

[62]Csikszentmihalyi, M. (1990) *Flow, the psychology of optimal experience*. New York: Harper Collins.

[63]Russell, J. A. (2009) Emotion, Core Affect, and Psychological Construction. *Cognition and Emotion*, 7, 1259 - 1283

[64] Barrett, L. F. (2006) Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review*, 10, 20-46.

[65] Russell, J. (1980) A circumplex model of affect. *Journal of Personality and Social Psychology*, 39(6), 1161-11178

[66] Besides the obvious issues with how the Barrett, Feldman and Russell model neglects to explain how emotions map to actual neuro-biological events or its inadequate semantics,

the model also incorrectly assumes that emotions are primarily conscious and are derived from normative or linguistic interpretations and not the abstract cognitions shared alike by animals and humans. Indeed, as Berridge argued, "*In Feldman-Barrett's view emotion requires the complex cognitive appraisals, language-based reasoning and sociocultural construal's of situations and meaning that only humans possess. This position continues a long tradition of earlier cognitive appraisal theories that reinterpreted emotions as essentially just another type of cognition, turning emotions essentially into cultural-linguistic representations of semantic meaning. Cognitivist academics focus on reasoning and language, and place such a high premium on rationality that they are inclined to see all psychological processes through a purely cognitive lens."* Berridge, K.C. Evolving concepts of emotion and motivation. *Frontiers in Psychology*, **9**, 1647, 1-20, 2018.

[67] Posner and colleagues argued for the emotional circumplex by deriving their model from Wundt's bi-polar affective axes of 'arousal/subduing', and 'pleasant/unpleasant'. Thus, "*The circumplex model of affect posits that the two underlying neurophysiological systems of valence and arousal subserve all affective states, and upon this substrate are layered various cognitive processes that interpret and refine emotional experience according to salient situational and historical contexts*." However, Wundt proposed a third axis that is commonly omitted in circumplex models of emotion, namely 'strain/relaxation'. Our model adds this dimension, and it is presumed, increases the descriptive and predictive power of the emotional circumplex.

Posner, J., Russell, J. A., & Peterson, B. S. (2005). The circumplex model of affect: an integrative approach to affective neuroscience, cognitive development, and

psychopathology. Development and psychopathology, 17(3), 715–734.

[68] Key to any scientific hypothesis is not that it is necessarily comprehensible, but that it is testable. The great theories in physics are beyond comprehension to most people, but gain credence because they make predictions that are readily falsified. The arguments in this book, regardless of their comprehensibility, or no different. The problem is that a narrative account of how motivation works is not an *explanation* if it suggests no easy way to falsify. This conflates explanation with mere description, and is a disservice to science. To accept a narrative is to eschew explanation, thus making understanding barren as it does nothing but take up space. The articles listed below point to this issue, but miss the mark by assuming that neuroscience has explanations when much of it has very little.

Fernandez-Duque D, Evans J, Christian C, Hodges SD. (2015) Superfluous neuroscience information makes explanations of psychological phenomena more appealing. Journal of Cognitive Neuroscience. **27(5)**:926-944.

Weisberg DS, Keil FC, Goodstein J, Rawson E, Gray JR. (2008) The seductive allure of neuroscience explanations. Journal of Cognitive Neuroscience. 20(3):470-7

[69] Harris, Marvin (1979) *Cultural Materialism: The Science for a Science of Culture.* New York: Random House

[70] Ryan, Richard M. & Deci, Edward (2000) Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, **25**, 54–67

[71] The well-known and accepted 'over-justification' effect presumes that extrinsic rewards can diminish intrinsic motivation, a notion that is absurd theoretically and has been demonstrated as false empirically. Since there are no separate intrinsic and extrinsic motivational processes,

positive expectancies from different internal (variability of work schedule) and extrinsic (positive expectancies from money or praise) generally complement each other, as is well demonstrated from personal experience where to be well rewarded for doing the things you love is generally regarded as the epitome of motivation and not a motivational conflict. Still, as per our discussion of perverse incentives, a monetary reward may be mis-construed by the receiving individual to incent an aspect of behavior that was not the intention of the individual who gave it. The resulting perversity of behavior does not mean the diminution of the normal rewarding attributes of a behavior, but rather a contrary behavior that is merely at odds with the 'intrinsically' reinforced performance.
Cameron, Judy and Pierce. W. David (1996) The Debate about Rewards and Intrinsic Motivation: Protests and Accusations Do Not Alter the Results Author(s): Judy Cameron and W. David Pierce Source: Review of Educational Research, Vol. 66, No. 1, pp. 39-51

[72] Recently, the literature of intrinsic motivation has added the neurobiology of dopaminergic systems to the equation. Characteristic of this research is the Domenico & Ryan article linked below. The article is very difficult to understand because it conflates different levels of analysis, from the molecular (dopamine systems) to the molar (psychological needs), with reliance on obscurely defined brain networks to imperfectly integrate them. Most significantly, 'extrinsic motivation' is not defined, a critical omission since intrinsic motivation denotes a contrasting set of neurologic processes than those engaged by extrinsic motivators. But by not defining extrinsic rewards, this begs rather than resolves the argument. Indeed, extrinsic motivators are discriminative stimuli that denote extensible

or future projected expectancies that are elicited by expectancies perceived in the moment and have cumulative motivational import. For example, the perception of moment-to-moment novel progress during a game also changes the future or 'extrinsic' implications of that behavior, such as a material prize, popular regard, etc., which mediate future expectancies in turn. Finally, the fact that intrinsic and extrinsic motivators have no reality in present neuro-biological models of incentive motivation and no mention at all in the history of learning theory from Pavlov onward calls into question whether separate extrinsic and intrinsic motivational states actually exist, or are merely artifacts of folk conceptualizations of how motivation works.

Overall, despite the inclusion of neurologic factors, intrinsic motivation remains part of a multi-variate theory of incentive motivation that is not systematically described and is resistant to falsification, while motivational theory deriving from animal studies has moved in the opposite direction, towards a uni-variate theory which posits fewer and more precisely described dependent and interdependent variables. Above all uni-variate theories are easily testable in terms of the neurological processes involved and the actual behavior (eating, drinking, addiction, etc.) those processes entail.

In addition, as quoted from the article below, the fact that intrinsic motivation is integrated with psychological 'needs', is activated by obscurely defined 'challenges' and 'inconsistencies', and entails dynamic switching between equally obscure 'salience', 'central executive' and 'default mode networks' renders the entire argument into merely syntax (words) with an uncertain or muddled semantics

(meaning), or in other words, psychobabble, with little prospect for clear refutation and test.

"*Intrinsic motivation depends on ambient supports for basic psychological needs, especially those for competence (feeling effective) and autonomy (feeling volitional).*"

"*Intrinsically motivated curiosity, exploration and mastery behaviors, however, pertain to specific types of novel stimuli, namely, those that present optimal challenges or optimal inconsistencies with one's extant knowledge and that accordingly energize tendencies to approach*."

"*Intrinsically motivated states entail dynamic switching between the salience, central executive and default mode networks.*"

A final observation is that Domenico and Ryan simply ignore the fact a radical behaviorism *does* admit affect, and that affect is also elicited and controlled by how reinforcement contingencies are structured, such as variable ratio or 'gambling' schedules where every move has surprising results. Indeed, extrinsic incentives such as money also result in the activation of dopamine systems and are therefore affective, as Knutson observed in the article linked below. Present models of reinforcement also use dopaminergic systems as key to incentive, but make no distinction between 'intrinsic' and 'extrinsic' processes save for the fact that extrinsic motivators map to future or extrinsic or perceptual events that are in public view, as compared to the present and private nature of intrinsic incentives. In this sense, since all behavior is guided by our conscious and nonconscious perceptions in the moment and cognitive projections of the future, all motivation is sourced to extrinsic events and realized by intrinsic processes. Therefore, the concept of a distinctive intrinsic reward is meaningless, as it is inextricably bound to extrinsic events. Also, nativistic tendencies, such as a 'seeking' response are

not denied in contemporary learning theory. Thus, the dismissive statement by the authors must be discarded as untrue, as the affective results of discrepancy or novelty is an intrinsic quality *of* response contingencies, and is not separate from them. *"...observations of spontaneous exploratory and play behaviors defied some behaviorist views that intentional behaviors are invariably controlled by reinforcement contingencies within the environment."*

Domenico S. I. & Ryan Richard M. (2017) The Emerging Neuroscience of Intrinsic Motivation: A New Frontier in Self-Determination Research.
Frontiers in Human Neuroscience, 11, 145
Knutson, B., & Greer, S. M. (2008). Anticipatory affect: neural correlates and consequences for choice. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *363*(1511), 3771–3786.

[73] *In politics and economics, a* ***Potemkin village*** *is any construction (literal or figurative) whose sole purpose is to provide an external façade to a country which is faring poorly, making people believe that the country is faring better. The term comes from stories of a fake portable village built solely to impress Empress Catherine II by her former lover Grigory Potemkin during her journey to the Crimea. While modern historians claim accounts of this portable village are exaggerated, the original story was that Potemkin erected phony portable settlements along the banks of the Dnieper river in order to impress the Russian Empress; the structures would be disassembled after she passed, and re-assembled farther along her route to be viewed again as if another example*. Wikipedia

[74] ***Confusopoly*** *(aka* ***Dilbert's confusopoly****) is confusing marketing designed to prevent the buyer making informed decisions. Dilbert's author Scott Adams defines confusopoly as "a group of companies with similar products who intentionally*

confuse customers instead of competing on price". For example, similar items like mobile phones are advertised at various price plans according to different combinations of available minutes, text messaging capabilities and other services, thus making these offers practically incomparable when it could be easy to price similar units of usage to allow informed comparisons. The term confusopoly also applies because confusion within the targeted consumer group is purposefully maintained, so choices are based on emotional factors

[75] Smith, Adam (1902) *The Wealth of Nations*, Princeton University

[76] The first air conditioning system was developed by John Gorrie in the Florida panhandle city of Apalachicola in 1851. The system was developed to be therapeutic with comfort a side benefit, as cooled and airtight sick rooms were just the cure for the bad air that was thought to be the source of malaria, along with his other proposal to just drain the swamp. https://en.wikipedia.org/wiki/John_Gorrie

[77] This interpretation of motivation in education is not new. Albert Shankar, the president of the American Federation of Teachers pointed out: telling eighth graders that they should work hard so that they could go to college five years later and then maybe get a good job after college graduation a few years after that provides little motivation for hard work. An orientation towards success requires that the rewards that reinforce be provided as quickly as possible-that is the type of short term thinking common among American business people.

[78] Wilson, E. O. (1998) *Consilience: The unity of knowledge*. New York: Knopf.

[79] https://www.intellectualtakeout.org/blog/why-professors-are-writing-crap-nobody-reads/

[80] Tipler, Frank (2003) Refereed Journals, do they ensure quality or enforce orthodoxy? ISCID Archive, June 3, 2003

[81] Internet Shakespeare Editions https://internetshakespeare.uvic.ca/Library/SLT/ideas/education/literacy.html

[82] Jamieson, Lee. "William Shakespeare's School Life, Childhood, and Education." ThoughtCo, Aug. 29, 2020, thoughtco.com/shakespeares-school-life-3960010

[83] MacGregor, Neil (2012) *Shakespeare's restless world: A portrait of an era in twenty objects*. New York, Viking

[84] Boorstin, D. (1992) *The Creators*. New York: Random House

[85] Shakespeare's renown eventually vaulted from a provincial stage to universal fame when his plays were published by two friends more out collegial responsibility than insuring a literary testament for the ages. That we even know who Shakespeare *was* was a near thing, as for his brilliance would likely be rejected even if submitted to a contemporary critical audience. This is illustrated by the infamous 'Step's' experiment, where the novel 'Steps', which won the national book award in 1969 and by 1975 had sold over 400,000 copies, was copied and sent under a pseudonym to literary publishers and agents.

…he submitted the entire book to fourteen publishers (the original four plus The Atlantic Monthly Press; Farrar, Straus & Giroux; Harper & Row; Alfred A. Knopf; Seymour Lawrence; David McKay; Macmillan; William Morrow; Prentice-Hall; and Viking). Again, every publisher rejected the work. Harcourt Brace Jovanovich, publisher of Kosinski's Being There, commented, "While your prose style is very lucid, the content of the book didn't inspire the level of enthusiasm here that a publisher should have for any book on their list in order to do well by it."

"Next, Ross sent queries to twenty-six literary agents. Again, no agent offered to represent him. Ross wrote that, "no one, neither publishers nor agents, recognized Kosinski's already published

book. Even more disappointing was the fact that no one thought it deserved to see print."

The same experiment was repeated when Ross re-typed the screenplay for the classic movie 'Casablanca', retitled as 'Everyone comes to Rick's', and resubmitted it to 127 agencies under the pseudonym of an unknown author 'Erik Demos'. *"Thirty-three agencies actually recognized the script. For instance, Alan Green of the Gage Group wrote back to Ross, "Unfortunately I've seen this picture before: 147 times to be exact." Eight noticed a similarity to Casablanca, but didn't realize it was Casablanca. However, thirty-eight agencies claimed to have read it, but rejected it. In other words, of those agencies that actually read the manuscript (or claimed to have), the majority did not recognize it as Casablanca, nor did they think the script was good enough to be worth representing. The comments Ross received included: "I just think you need to rework it... you have excessive dialogue at times." "To bridge the gap between 'talented writer', which you now are, and 'professional writer', which is yet to come, you need professional help. And that will have to be paid for. I could recommend a 'literary surgeon' who would help you, but are you ready to accept professional help????" "I think the dialogue could have been sharper and I think the plot had a tendency to ramble. It could've been tighter and there could have been a cleaner line to it." "I gave you five pages to grab me -- didn't do it." "Too much dialogue, not enough exposition, the story line was weak, and in general didn't hold my interest." "Story line is thin. Too much dialogue for amount of action. Not enough highs and lows in the script." "I strongly recommend that you leaf through a book called Screenplay by Syd Field, especially the section pertaining to dialogue. This book may be an aid to you in putting a professional polish on your script, which I feel is its strongest need."*

The result of these experiments, doubtless vouched by almost all aspiring authors, is that writing for a national stage is fool's errand, as few will judge you, and fewer will pay attention.

Ross, Chuck. (November-December, 1982). "The Great Script Tease." *Film Comment*. 18(6): 15-19.

Orthofer, M.A. (February, 2001). "Facts and Fakes: Considering Eliot Weinberger's Genuine Fakes." *Complete Review Quarterly*. II(1).

http://hoaxes.org/archive/permalink/the_steps_experiment

[86] In Homer's Odyssey, this was the fate of Odysseus's crew, who succumbed to the supine pleasure of eating lotus leaves until Odysseus roused them back to the ship, to their great lament. This theme was later adopted in the excellent Start Trek episode, "This Side of Paradise". But perhaps Homer put it best in his great work:

"*I was driven thence by foul winds for a space of 9 days upon the sea, but on the tenth day we reached the land of the Lotus-eaters, who live on a food that comes from a kind of flower. Here we landed to take in fresh water, and our crews got their mid-day meal on the shore near the ships. When they had eaten and drank, I sent two of my company to see what manner of men the people of the place might be, and they had a third man under them. They started at once, and went about among the Lotus-eaters, who did them no hurt, but gave them to eat of the lotus, which was so delicious that those who ate of it left off caring about home, and did not even want to go back and say what had happened to them, but were for staying and munching lotus with the Lotus-eaters without thinking further of their return; nevertheless, though they wept bitterly I forced them back to the ships and made them fast under the benches. Then I told the rest to go on board at once, lest any of them should taste of the lotus and leave off wanting to get home, so they took their places and smote the grey sea with their oars*."

https://en.wikipedia.org/wiki/This_Side_of_Paradise_(Star_Trek:_The_Original_Series)
https://en.wikipedia.org/wiki/Lotus-eaters

[87] Hamid AA, Pettibone JR, Mabrouk OS, Hetrick VL, Schmidt R, Vander Weele CM, Kennedy RT, Aragona BJ, Berke JD. (2016) Mesolimbic dopamine signals the value of work. *Nature Neuroscience*, Jan;19(1):117-26.

[88] New York time article on choice "Even when it actually hurts you on average to take the gamble, the smart people, the high-scoring people, actually like it more," Professor Frederick said in an interview. Almost a third of high scorers preferred a 1 percent chance of $5,000 to a sure $60. They are also more patient, particularly when the difference, and the implied interest rate, is large. Choosing $3,400 this month over $3,800 next month implies an annual discount rate of 280 percent. Yet only 35 percent of low scorers -- those who missed every question -- said they would wait, while 60 percent of high scorers preferred the later, bigger payoff.
https://www.nytimes.com/2006/01/26/business/would-you-take-the-bird-in-the-hand-or-a-75-chance-at-the-two-in.html

[89] *Hume shows that experience does not tell us much. Of two events, A and B, we say that A causes B when the two always occur together, that is, are constantly conjoined. Whenever we find A, we also find B, and we have a certainty that this conjunction will continue to happen. Once we realize that "A must bring about B" is tantamount merely to "Due to their constant conjunction, we are psychologically certain that B will follow A", then we are left with a very weak notion of necessity. This tenuous grasp on causal efficacy helps give rise to the Problem of Induction–that we are not reasonably justified in making any inductive inference about the world. Among Hume*

scholars it is a matter of debate how seriously Hume means us to take this conclusion and whether causation consists wholly in constant conjunction. Internet Encyclopedia of psychology. https://iep.utm.edu/hume-cau/

[90] The placebo effect is coupled to the common erroneous assumption that *normative* rather than *abstract* expectancies will increase opioid release, or in other words, just the cognitive operation or belief that pain will be relieved will make it so.

For example, it is an established fact that placebos have analgesic or pain-relieving effects. Cognitively, a placebo denotes to a user valid information, and changes expectancies and resolves conflicts, thus worries or concerns about personal efficacy, health, and other personal matters are eliminated in expectation of a cure, therefore inducing a state of relaxation. Since endogenous opioids are induced by relaxed states, the question is whether analgesia is due to this factor or to other neurological states activated by expectancy. In an experiment that presented subjects with pharmacologic placebos, reported analgesia was significantly reduced for those subjects who also received the opioid blocker, naloxone, and reported pain was the same as individuals who did not receive a pharmacologic placebo. In other words, endogenous opioids as elicited by abstract expectancies or discrepancies were primarily responsible for placebo induced analgesia, with normative expectations of relief of negligible effect.

Amanzioa, M , Polloa, A , Maggib, G, & Benedettia, F. (2001) Response variability to analgesics: a role for non-specific activation of endogenous opioids, *Pain*, 90, 201-215

Benedetti, F., Carlino, E., & Pollo, A. (2011). How placebos change the patient's brain. Neuropsychopharmacology :

official publication of the American College of Neuropsychopharmacology, 36(1), 339–354.

[91] Dawes, Robyn (1994) *House of Cards: Psychology and Psychotherapy built on myth*. New York: Simon and Schuster

[92] As discussed by John Horgan in his book 'The Undiscovered Mind', the unique curative powers of psychotherapy are not unique to a form of talking cure, but to *all* forms of talking cures. Characteristic of this position was the work of the psychologist Lester Luborsky. "*He and his colleagues reviewed studies of different psychotherapies. They concluded that psychotherapy was worthwhile; those who received therapy generally fared better than those who did not. On the other hand, none of the therapies stood out; all were roughly as effective as each other."*

Luborsky, L. & Singer, B., (1975). Comparative studies of psychotherapies: Is it true that "everyone has won and all must have prizes"? Archives of General Psychiatry, 32(8), 995–1008.

[93] The unique mental state of 'hypnosis' was born in fraud, namely the antics of Franz Anton Mesmer, an 18th century charlatan who *hypothesized the existence of a natural energy transference occurring between all animated and inanimate objects; this he called "animal magnetism" sometimes later referred to as mesmerism. Mesmer's theory attracted a wide following between about 1780 and 1850 and continued to have some influence until the end of the 19th century. In 1843 the Scottish doctor James Braid proposed the term "hypnosis" for a technique derived from animal magnetism; today the word 'mesmerism' generally functions as a synonym of "hypnosis"*. Wikipedia

Hypnosis is hypothesized to be unique motivational state that corresponds to unique but generally obscure (trance, cortical dissociation) or commonplace (relaxation,

attention) neuro-physiological states. A countervailing view, well established in experiment and observation, is that 'hypnosis' is merely a classification for unique behaviors that are caused by unique expectancies. Indeed, compiling and discussing hundreds of experiments, the psychologist T.E. Barber demonstrated that motivation/try expectancies, bereft of any incantation to assume as trancelike, relaxed, or otherwise 'hypnotic' state, sufficed to elicit 'hypnotic' behaviors, rendering the surplus meaning of a unique entity called hypnosis, well, surplus.

Barber, T. E. (1969) *Hypnosis, A Scientific Approach*. New York: Van Nostrand

[94] *"Say you look at information on a yearly basis, for stock prices or the fertilizer sales of your father-in-law's factory, or inflation numbers in Vladivostok. Assume further that for what you are observing, at the yearly frequency the ratio of signal to noise is about one to one (say half noise, half signal) —it means that about half of changes are real improvements or degradations, the other half comes from randomness. This ratio is what you get from yearly observations. But if you look at the very same data on a daily basis, the composition would change to 95% noise, 5% signal. And if you observe data on an hourly basis, as people immersed in the news and markets price variations do, the split becomes 99.5% noise to .5% signal. That is two hundred times more noise than signal —which is why anyone who listens to news (except when very, very significant events take place) is one step below sucker…To conclude, the best way to is to mitigate interventionism is to ration the supply of information, as naturalistically as possible. This is hard to accept in the age of the internet. It has been very hard for me to explain that the more data you get, the less you know what's going on…"* Nicolas Taleb

[95]Kamin, L.J. (1969). Predictability, surprise, attention, and conditioning. In B. A. Campbell and R. M. Church (Eds.)

Punishment and Aversive Behavior. New York: Appleton-Century-Crofts (Pages 279-296).

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[106] Brennan, K., Roberts, D., Anisman, H. *et al.* (2001) Individual differences in sucrose consumption in the rat: motivational and neurochemical correlates of hedonia. *Psychopharmacology* 157, 269–276

[107] Rauwolf, P., Millard, S. K., Wong, N., Witt, A., Davies, T. J., Cahill, A. M., Madden, G. J., Parkinson, J. A., & Rogers, R. D. (2021). "Just not knowing" can make life sweeter (and saltier): Reward uncertainty alters the sensory experience and consumption of palatable food and drinks. *Journal of Experimental Psychology: General*, 150(10), 2015–2035.

[108]Gorwood P. (2008). Neurobiological mechanisms of anhedonia. *Dialogues in Clinical Neuroscience*, 10(3), 291–299.

[109] Wikipedia

[110] Wikipedia Girolamo Savonarola

[111] Giegerenzer, G. (2008) "Why Heuristics Work." *Perspectives in Psychological Science*, **3**(1), 20-29

[112] Harris, Marvin (1979) *Cultural Materialism: The Struggle for a Science of Culture*. Random House, New York

[113] *Freakonomics helps you make better decisions by showing you how your life is dominated by incentives, how to close information asymmetries between you and the experts that exploit you and how to really tell the difference between causation and correlation.* The position of Levitt and Dubner is that economics is at root the study of incentives, to which this author observes that they study how incentives are used, not their explanation. In their two books on 'Freakonomics', they provide entertaining, and for the most part persuasive

accounts of the subtle and often hidden role of incentive in our daily lives. However, what incentives *are* is not their concern, leaving larger issues of personal self-control and the management of culture in abeyance. Levitt, Stephen B. and Dubner, Stephen J. (2005) *Freakonomics: A rogue economists explores the hidden side of everything*. New York, Harper

[114] Wikipedia

[115] Wikipedia

[116] Economics is the social science that studies how people interact with value, and has until recently been concerned with how people determine value as rational actors, whereas psychologists have been concerned with how humans determine value as *irrational* actors. The fact that rationality is determined by the observed order of the outside world whereas irrationality has indeterminate and internalized causes has historically created a neat dichotomy between psychology and economics, with the former quick to propose different *kinds* of incentive and the latter different *sources* of incentive. Thus psychologists follow the model of Sigmund Freud, who postulated different psychological drivers for behavior, with economists following the model of Sherlock Holmes, who held a magnifying glass to reveal the subtle presence of incentives, and the guilty parties who benefit from them.

But this distinction has of recently been blurred. The emerging field of *behavioral economics* re-introduces cognitive mediators between incentives and behavior such as 'framing effects', 'anchoring', 'mental accounting', and 'herd behavior' that alter the magnitude and direction of incentives while still ignoring neuro-biological explanations of incentive. As is the case with cognitive psychology, this results in piecemeal explanations of

behavior and non-interlocking eclectic theories of middle scope that do not derive from true explanation of behavior. Indeed, understanding *why* behavior occurs is necessary for the creation of generalizable knowledge, and this requires a full understanding of the neurobiological roots of incentive. As the economist David Gal argued, this provides correlations but begs explanations, which trivializes many of the important issues in economics.

To Gal, many of these issues stem from behavioral economics being too concerned with understanding *how* behavior deviates from standard economic models rather than with understanding *why* people behave the way they do. Understanding why behavior occurs is necessary for the creation of generalizable knowledge, the goal of science. He has referred to behavioral economics as a "triumph of marketing" and particularly cited the example of loss aversion.[41] *"Opinion | Why Is Behavioral Economics So Popular?"*. *Retrieved 2018-11-*16.

"Only if we understand why a behavior occurs can we create generalizable knowledge, the goal of science. In practice, much of behavioral economics consists in using psychological insights to influence behavior. These interventions tend to be small, often involving subtle changes in how choices are presented: for example, whether you have to "opt in" to a 401k savings plan versus having to "opt out." In this respect, behavioral economics can be thought of as endorsing the outsize benefits of psychological "tricks," rather than as calling for more fundamental behavioral or policy change.

The popularity of such low-cost psychological interventions, or "nudges," under the label of behavioral economics is in part a triumph of marketing. It reflects the widespread perception that

behavioral economics combines the cleverness and fun of pop psychology with the rigor and relevance of economics.
Yet this triumph has come at a cost. In order to appeal to other economists, behavioral economists are too often concerned with describing how human behavior deviates from the assumptions of standard economic models, rather than with understanding why people behave the way they do."
[117] http://esr.ibiblio.org/

[118] *A positive reason for seeing Stoicism as influential on Marcus is that most of the Meditations are strongly reminiscent of Stoic ideas, even if Marcus does not use technical Stoic vocabulary and sometimes recasts these ideas in his own distinctive ways. We can identify at least five features which were seen in this period as distinctive of Stoicism; and they match strongly marked themes in the Meditations. One is the idea that the virtuous life is identical with the happy life (that virtue is all that is needed to ensure happiness). Other things widely regarded as good, such as health or material prosperity and even the well-being of one's family and friends, are seen as being irrelevant for happiness; they are 'matters of indifference', even if they are naturally 'preferable'. A second theme is that emotions and desires depend directly on beliefs about what is valuable or desirable; they do not form a separate (non-rational) dimension of psychological life. The emotions and desires most people form are seen as shaped by mistaken ethical beliefs and in this sense as being psychological 'sicknesses'. A third theme is that human beings have an in-built natural inclination to benefit others. This inclination, if properly developed, is expressed both in full-hearted engagement with family and communal roles and in a readiness to accept all human beings, as such, as part of a 'brotherhood' or 'cosmic city' and as proper objects of ethical concern. These three ideas add up to a highly idealized view of human ethics and psychology, one that ancient critics thought was over-idealistic and unrealistic. None*

the less, the Stoics maintained that all human beings are fundamentally capable of progressing towards the ideal state of complete virtue and happiness, though they admitted that no one had perhaps achieved this completely. Hence, ethical life, for Stoicism, consisted in an ongoing process or journey towards this goal, a journey for which their methods of practical ethics were a means of support. Christopher Gill, and is taken, with kind permission of *Oxford World's Classics*, from the Introduction (xv-xvi) to *Marcus Aurelius: Meditations with selected correspondence,* trans. Robin Hard, with Introduction and Notes by Christopher Gill. https://modernstoicism.com/perspectives-chris-gill-on-the-core-ideas-of-stoic-ethics-part-one/

[119] Barrow, J. and Tipler, F. (1988) *The Anthropic Cosmological Principle*. Oxford University Press

[120] https://modernstoicism.com/perspectives-chris-gill-on-the-core-ideas-of-stoic-ethics-part-one/

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[124] Horgan, John (1996) *The End of Science: Facing The limits of knowledge in the twilight of the scientific age*. Philadelphia: Perseus

[125] Kurzweil, R. (2005) *The singularity is near: when humans transcend biology*. New York: Viking

[126] https://en.wikipedia.org/wiki/Three_Laws_of_Robotics

[127] Horgan, John (1999) *The Undiscovered Mind*. New York: Touchstone

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[129] Deutsch, D. (1997) *The Fabric of Reality*. New York: Penguin

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